

<http://researchcommons.waikato.ac.nz/>

Research Commons at the University of Waikato

Copyright Statement:

The digital copy of this thesis is protected by the Copyright Act 1994 (New Zealand).

The thesis may be consulted by you, provided you comply with the provisions of the Act and the following conditions of use:

- Any use you make of these documents or images must be for research or private study purposes only, and you may not make them available to any other person.
- Authors control the copyright of their thesis. You will recognise the author's right to be identified as the author of the thesis, and due acknowledgement will be made to the author where appropriate.
- You will obtain the author's permission before publishing any material from the thesis.

**Teachers' perceptions of professional learning through
social media in environmental education**

A thesis

submitted in fulfilment

of the requirements for the degree

of

Doctor of Philosophy in Education

at

The University of Waikato

by

FARIBA MOSTAFA



THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

2020

Abstract

Increasingly rapid consumption of natural resources and the production of wastes and their impacts on ecosystems have become unsustainable practices due to the increase in population, technological development and economic growth. The role of environmental education (EE) has been highlighted for promoting more sustainable ways of living by improving knowledge, behaviour and action to address environmental challenges and help society to shift toward sustainability.

Environmental education is positioned in New Zealand education as an interdisciplinary teaching and learning approach. The non-mandatory status of EE emphasises an holistic approach to meeting the aims of EE. However, teachers face some challenges integrating the complex and evolving content of EE into school curricula due to lack of support and professional learning opportunities. Collaboration for teachers could help them to share their experiences with challenges regarding teaching and learning in EE. Building connections between teachers could help them to increase their knowledge and enhance their teaching practice, which in turn could affect students' learning.

Social media is used for collaborative learning in diverse disciplines for various purposes. It has the potential to be used for teacher professional learning (TPL) as communication and resources can be combined to create collaborative learning opportunities. However, there is little evidence to date of its use in TPL in EE. Considering the advantages and the possibility of social media for use in TPL in EE, the purpose of this study was to explore teachers' perceptions of professional learning through social media in EE in New Zealand.

A mixed method study was designed and conducted in three phases using a phenomenographic approach. Findings from questionnaires and interviews in the first and second phases suggested that teachers see TPL through social media as potentially collaborative, convenient, and ubiquitous. They also believed building connections through social media can help EE teachers interact with peers and experts, as well as access support and resources to enhance their teaching practice. Despite these benefits, some teachers perceived this kind of TPL to be challenging. Time for engagement, the accuracy of shared information, privacy of participation, unfocused information and the conflict between online learning and EE as a practical subject were mentioned as the barriers of learning through social media. Specifically, the lack of educational support and

lack of TPL were identified as challenges for secondary teachers who engaged with Achievement Standards related to education for sustainability (EfS).

These findings were used to design and establish a learning community for secondary school teachers through Google+ in the third phase. The Google+ Community facilitated synchronous and asynchronous interactions between teachers and EE experts in different locations. Teachers, however, were not fully engaged in community activities. Findings from interviews and document analysis in the third phase suggested that some limitations associated with the community coupled with teachers' priorities shaped participants' involvement in the community. Participants claimed that they needed motivation and time to become actively engaged in the community.

This research contributes to an understanding of teachers' perceptions and experiences of professional learning through social media in EE. Insights gained from this study relate to both possibilities and challenges of learning through social media. It also highlights the vital role EE stakeholders play in TPL in EE and their influence on teachers' motivation. A number of strategies that are suggested at the end of this thesis can be of use in designing TPL in general, TPL in EE, and TPL through social media in particular.

Acknowledgements

This thesis is dedicated to the memory of my father, who is gone, but whose belief in me motivated me to start this journey, and to my mother, whose unflagging emotional support and prayers have made this journey possible.

I believe that this study would not have been possible without the guidance, contribution, encouragement, help, and support provided by people who believed in and helped me. First, I would like to express my sincere gratitude to my supervisors, Associate Professor Chris Eames and Dr Dianne Forbes, for their immense knowledge, continual support, advice, and guidance, which have helped me throughout the research and writing of this thesis. I cannot imagine better guidance or better mentors for my PhD. Also, for sharing their experience, knowledge, and practice with me, I wish to thank the teachers who participated in my study, gave their time to interviews, and took part in the learning community. My thanks to Helen and Blake; this thesis would not have been possible without them. I would also like to express my sincere appreciation to the following:

- My third supervisor, Dr Claudio Aguayo, for his support, suggestions, and feedback for the completion of the thesis. Also, Prof John Williams, for his support and encouragement as my initial second supervisor at the start of my PhD programme.
- Dr Miles Barker, for providing information and directing me in the right direction to apply for the PhD programme.
- My sons, Sina Enteshari and Shantia Enteshari, for their love, support, encouragement, patience, and commitment. Thank you so much for standing with me.
- My fellow PhD candidates at TEMS Education Research Centre, for their collegial support and encouragement.
- My subject librarian, Mel Chivers, for dealing with my endless questions and for her great help in formatting this thesis.
- My manager, Julie Wilhelm, for believing in me and my ability to work. Without her support, I would not have been able to study.

Conference and Seminar presentations arising from this thesis

Mostafa, F. (2016). Applying learning theories in teacher professional learning through social media in environmental education. Paper presented at *Postgraduate Global connection symposium*, October 2016. Faculty of Education, University of Waikato, New Zealand.

Mostafa, F. (2016). Phenomenographic approach in the research on teacher professional learning in environmental education through social media. Paper presented at *TEMS Graduate Symposium*, November 2016. University of Waikato, New Zealand.

Mostafa, F. (2017). Teacher collaboration through social media in environmental education: A phenomenographic approach. Paper presented at *Postgraduate Global connection symposium*, October 2017. University of Waikato, New Zealand.

Mostafa, F. (2017). Social Media in Teacher Professional Learning: Opportunities and Challenges for Environmental Education Teachers. Paper presented at the *New Zealand Association for Research in Education (NZARE) conference*, November 2017, University of Waikato, Hamilton, New Zealand.

Mostafa, F. (2018). Collaboration for teaching environmental education: Professional learning through social media for environmental education teachers. Paper presented at 8th Biennial Conference for the *New Zealand Association for Environmental Education (NZAEE)*. April 2018, Wellington Girls College, Wellington, New Zealand.

Mostafa, F. (2018). Utilizing social media to create capacity for change in teacher professional learning in environmental education. Paper presented at *the Australian Association for Environmental Education (AAEE)*, October 2018, Southern Cross University, the Gold Coast, Australia.

Mostafa, F. (2018). A learning community for environmental education teachers through social media. Paper presented at *TEMS Graduate Symposium*, November 2018. University of Waikato, New Zealand.

Table of Contents

Abstract.....	i
Acknowledgements	iii
Conference and Seminar presentations arising from this thesis	iv
List of Figures.....	x
List of Tables	xi
Chapter One: Introduction	1
1.1 Justification and rationale for the study	1
1.2 Significance of the topic	4
1.3 Statement of research questions.....	6
1.4 My interest and motivation in this study	6
1.5 Overview of the research design.....	7
1.6 Overview of the thesis	8
Chapter Two: Literature review	11
2.1 Environmental education	11
2.1.1 Definitions and aims of environmental education.....	11
2.1.2 The history of environmental education.....	17
2.1.3 Environmental education in New Zealand.....	21
2.1.4 The Enviroschools Programme	25
2.1.5 Teaching, teachers and environmental education	26
2.1.6 Environmental education as a term in this study.....	28
2.1.7 Section summary	28
2.2 Teacher professional learning.....	29
2.2.1 Teacher professional learning approaches	29
2.2.2 Teacher collaboration.....	32
2.2.3 Teacher collaboration in professional learning communities	33
2.2.4 Teacher professional learning for 21 st century education	35
2.2.5 Teacher professional learning in environmental education.....	36
2.2.6 Section summary	37
2.3 Social media and social learning	38
2.3.1 What is social media?.....	39
2.3.2 Social media in this research.....	40
2.3.3 Social media for learning	41
2.3.4 Theories for teacher professional learning.....	43
2.3.5 Teacher professional learning through social media.....	51

2.3.6 Rationale for teacher professional learning through social media in environmental education	55
2.3.7 Section summary	58
2.4 Chapter summary	59
Chapter Three: Methodology and Methods	61
3.1 Chapter overview	61
3.2 The research paradigm	61
3.3 The research approach: Phenomenography	63
3.4 My position as a researcher	65
3.5 The research design	66
3.5.1 Phase one: Questionnaire	68
3.5.2 Phase two: Interviews.....	75
3.5.3 Phase three: The learning community	85
3.6 Trustworthiness.....	93
3.6.1 The research credibility	94
3.6.2 Transferability	95
3.6.3 Dependability	96
3.6.4 Confirmability	97
3.7 Ethical considerations	97
3.7.1 Avoiding harm to participants.....	97
3.7.2 Informed consent.....	98
3.7.3 Privacy and confidentiality.....	98
3.8 Chapter summary	99
Chapter Four: The participants' background information.....	101
4.1 Demographic characteristics and background information of participants	101
4.1.1 Distribution of the respondents by gender and age	101
4.1.2 Distribution of the respondents by educational setting	102
4.1.3 Distribution of the respondents by years of teaching and years of their involvement in environmental education	103
4.1.4 Teachers' confidence to teach environmental education	104
4.1.5 Demographic summary	104
4.2 The participants' social media usage patterns	105
4.2.1 Devices and places to engage with social media.....	105
4.2.2 Teachers' preferred social media platforms for different purposes	106
4.2.3 Frequency of teachers' activities through social media	109
4.2.4 Summary of participants' social media usage patterns	111
4.3 Teachers' perceptions of teaching and learning in environmental education.....	112

4.4 Teachers' perceptions and experiences of professional learning in environmental education	114
4.4.1 Participants' perceptions of teacher professional learning methods	114
4.4.2 Teachers' perceptions of effective teacher professional learning characteristics	116
4.4.3 Teachers' perceptions of collaborative learning in environmental education	118
4.4.4 Section summary	119
4.5 Chapter summary	120
Chapter Five: Teachers' perceptions of professional learning and professional learning through social media in Environmental education	122
5.1 Overview of participants' perceptions of professional learning through social media in Environmental education	122
5.1.1 Section summary	127
5.2 Advantages and possibilities of professional learning through social media in environmental education	128
5.2.1 Collaboration and support opportunities for teachers	128
5.2.2 Ubiquitous learning opportunities for teachers	132
5.2.3 A learning approach for the 21st century	134
5.2.4 Access to wider connection and reduce isolation.....	134
5.2.5 Section summary	136
5.3 Teachers' challenges and concerns of professional learning through social media	137
5.3.1 Time	138
5.3.2 Information.....	141
5.3.3 Technical challenges, lack of technology, skills and awareness.....	142
5.3.4 Privacy concerns, and online Behaviour	143
5.3.5 No interest in learning through social media	143
5.3.6 Social media is a source of distraction.....	145
5.3.7 Concern about having a temporary learning network or downgraded information.....	145
5.3.8 Intellectual property, copyright and infringement.....	145
5.3.9 Section summary	146
5.4 Possible strategies to overcome challenges of teacher professional learning through social media in Environmental education	147
5.4.1 Using different networks for different years and subjects	147
5.4.2 Combining face to face learning and learning through social media.....	148
5.4.3 Utilising a user-friendly platform, a straightforward network and a closed group	149
5.4.4 Administration.....	151

5.4.5 Other suggestions	152
5.4.6 Section summary	153
5.5 Chapter summary	153
Chapter Six: A learning community through social media	156
6.1 The research aims in Phase three	156
6.2 Implementation of findings from Phase one and Phase two into third phase.....	156
6.2.1 The basis for Phase three.....	157
6.2.2 Selection of social media platform.....	157
6.2.3 Rationale for focusing on secondary school teachers	159
6.2.4 Rationale for establishing a closed community.....	160
6.2.5 Section summary	161
6.3 The EEfS Community on Google+.....	162
6.3.1 The Strategy	162
6.3.2 The administrator	165
6.3.3 The participants	166
6.3.4 Section summary	170
6.4 The activities of the EEfS Community	171
6.4.1 Synchronous activities.....	172
6.4.2 Asynchronous activities	174
6.4.3 Section summary	180
6.5 Participants' perceptions and experiences of professional learning as EEfS Community members.....	181
6.5.1 The Community's strengths	181
6.5.2 Community weaknesses	186
6.5.3 Teachers' challenges and factors limiting their involvement.....	189
6.6 Participants' suggestions to improve teachers' engagement in the EEfS Community	195
6.7 Chapter Summary	197
Chapter Seven: Discussion, conclusions, and recommendations	199
7.1 Discussion	199
7.1.1 How do teachers, who are engaged in environmental education, use social media in general and in their professional learning in particular?	200
7.1.2 How do teachers, who are engaged in environmental education, perceive their professional learning in environmental education?.....	203
7.1.3 How do teachers, who are engaged in environmental education, perceive teacher professional learning through social media in environmental education?	208
7.1.4 How does a group of teachers, who are engaged in environmental education, become involved in a professional learning community through social media? ..	212

7.1.5 How does a group of teachers, who are engaged in a professional learning community, experience professional learning through social media in environmental education?.....	215
7.2 Interconnected learning communities: A model for teacher professional learning through social media in environmental education	219
7.3 Limitations of applying social learning theories in this study	221
7.4 Tensions in teachers' perceptions of professional learning through social media	223
7.5 Conclusions.....	225
7.6 Implications and recommendations	227
7.7 Limitations of the study	229
7.8 Suggestions for further research	230
References	231
Appendices	254
Appendix A: Questionnaire (Phase one)	254
Appendix B: Email to Enviroschool lead teachers (Phase one)	264
Appendix C: Interview questions Phase two	269
Appendix D: Call for participation (Phase three)	272
Appendix E: The EEfS Google+ strategy (Phase three).....	273
Appendix F: EEfS Google+ post	281
Appendix G: Ethics application approval	282
Appendix H: Information sheet and consent form (Phase two).....	283
Appendix I: Information letter and consent form (Phase three)	285
Appendix J: EEfS Google+ post.....	288

List of Figures

Figure 1.1 Overview of the research design	8
Figure 2.1 The research's theoretical framework based on connectivism	51
Figure 3.1 The research question(s) in each phase	67
Figure 3.2 Phase three procedure	93
Figure 4.1 Respondents' years of teaching and years of teaching EE.....	104
Figure 4.2 Descriptive statistics of EE teachers confident to teach EE.....	104
Figure 4.3 Social media usage patterns among EE teachers	106
Figure 4.4 Suggested social media platforms to be use for TPL in EE.....	108
Figure 4.5 Frequency of participants' activities on social media.....	111
Figure 5.1 Teachers' views regarding the potential of social media for TPL in EE	124
Figure 5.2 Potential of social media for TPL in EE	124
Figure 5.3 Likelihood of teachers' joining a social media network	125
Figure 5.4 Likelihood of teachers' joining a social media network	126
Figure 5.5 Teachers' preferred TPL method in EE	127
Figure 5.6 Participants' suggestion to overcome barriers of TPL through social media	147
Figure 7.1 Interconnected learning communities	220

List of Tables

Table 2.1 Characteristics of social learning theories.....	44
Table 3.1 Research design	67
Table 3.2 Sections of the questionnaire and their descriptions	70
Table 3.3 Data collection procedure.....	73
Table 3.4 Description of the research participants	76
Table 3.5 The process of interview preparation	84
Table 3.6 Steps to the EEfS establish Google+ Community.....	87
Table 3.7 Phase three participants	89
Table 4.1 Demographic characteristics of respondents	102
Table 4.2 Descriptive statistics of respondents' educational setting	103
Table 4.3 Descriptive statistics of the type of device and place that teachers engage with social media	106
Table 4.4 Teachers' views about teaching EE and sustainability.....	112
Table 4.5 Teachers' perceptions of effective TPL methods in improving teachers' knowledge and skills in EE	115
Table 4.6 Participants' preferred teacher professional learning methods in EE	116
Table 4.7 Participants' ratings of the importance of TPL features.....	116
Table 5.1 Teachers' views regarding social media use for TPL in EE	123
Table 6.1 The preliminary strategy for EEfS community	163
Table 6.2 The administrator's activities based on the Strategy	166
Table 6.3 Summary of the EEfS webinars' topics and discussions	173
Table 6.4 The community activities, Questions and Discussions	176
Table 6.5 The Community' activities, Resources.....	180
Table 7.1 Social learning theories and their limitations in this study.....	223

Chapter One:

Introduction

This study finds its terms of reference in the field of environmental education (EE), with a particular interest in teacher professional learning (TPL) through social media in the New Zealand context. The introductory chapter provides background information for the research and aims to establish the concerns and motivations leading to the research question. The first part of the chapter provides the justification and rationale underlying the study. Next, the significance of the research, the research questions, and the researcher's interest and motivation for undertaking the study are discussed, and an overview of the research design is included. Finally, an outline of the thesis ends the chapter.

1.1 Justification and rationale for the study

Humans have lived on Earth and established a social system in relative harmony with ecosystems for thousands of years. Our ancestors' sustainable lives have shown that satisfying human needs from nature without compromising the integrity of ecosystems is possible. These long-lasting, sustainable, ancient economic and cultural systems are the result of indigenous knowledge and cultural beliefs. Indigenous societies' perceptions of the environment as a whole led them to "respect and love the land as a mother, treating it as sacred, believing that people, plants, animals, water, the land and the sky are all part of the same ongoing cycles of life" (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2002, p. 3). With this worldview, humans pursued and satisfied their various needs from the natural environment and established social systems. These philosophies have been passed to their next generations through a wide range of cultural practices such as "stories, dances, ceremonies and art as well as networks of sacred places" (UNESCO, 2002, p. 3).

While indigenous peoples with low populations and less damaging technologies have lived in harmony with nature, technological development interacting with economic growth and demand has had an adverse impact on the natural environment, particularly since the industrial revolution (Rockström et al., 2009). With booming growth in world population, enough food has to be produced to meet their needs. Natural resources are getting used at an increasing rate with the population increase (Barlow, 2003; Bergstrom,

2016; Wals, 1990). The increasingly rapid consumption of natural resources has become an unsustainable practice. The increase in population, coupled with unsustainable consumption has also resulted in more waste generated, more fossil fuels used and elevated energy needs. In an effort to meet increasing demand for energy, nuclear power has been used in many countries. Its use has contributed to natural and social disasters (Ramana, 2009).

The prevailing political pursuit of capitalism in many countries requires economic growth continuously, which involves unsustainable and increasing demands on the environment. Advanced technology has contributed to this, creating environmental problems. For example, innovation in nanotechnology, genetic engineering, and radioactive materials can all cause toxic waste generation. Human activities have affected the natural environment not only by exploitation of resources but also by waste disposal and pollution (Goudie, 2018). Waste disposal of, particularly, electronic and toxic wastes has created major environmental issues (Awasthi, Zeng, & Li, 2016; Musee, 2011). For example, nanotechnology waste disposal is a complex challenge of waste management as a nanowaste stream is classified as toxic to very toxic which has potential hazards during the disposal phase (Musee, 2011). The huge amount of waste and improper waste disposal causes pollution of water, air, and soil (UNEP, 2012).

Agriculture and food production has also brought some the noticeable changes in the environment in terms of ecosystem health. Chemical usage in the agricultural sector and the methods which have been used in food production are more efficient but are often not safe for ecosystems (Bowler, 1992). Water quality and availability is being affected by climate change and the use of a large amount of water due to population growth (Millennium Ecosystem Assessment, 2005). In some regions, poor water quality can affect people and the environment (Hewitt et al., 2007). Water pollution is increasing from phenomena like acid rain, eutrophication, industries, agriculture and urban runoff. Water shortages have resulted in reduced food production, which in turn leads to declining health and increasing poverty and other social problems (Millennium Ecosystem Assessment, 2005).

Poverty, violence, wars, increasing crime rate, human trafficking, gender, race and religion discrimination, and social inequality are some of the major social problems facing the world today (Bezdek et al., 1995; Mahdavi, 2014). These social issues, for

example war, are also making the world less sustainable by affecting the natural environment through air, water and soil pollution (Brimblecombe, 2019; Drumbi, 1998; Lawrence, Stemberger, Zolderdo, Struthers, & Cooke, 2015). Poverty, which impacts on the daily lives of individuals worldwide, puts tremendous pressure on the natural environment as well as social systems (Millennium Ecosystem Assessment, 2005). The cycle of poverty starts when a person falls below the level of certain needs. Lack of nutrition and health, lower levels of education, lack of employment opportunities, and therefore, poverty, occur progressively (Chambers, 2006). These conditions can lead to various criminal activities, as the poor strive to meet their needs, which influences our social systems. These social issues are linked to economic problems as seen with the Global Financial Crisis of 2008-9 where people striving to satisfy their needs and wants (supported by a capitalist notion of a better life for all) showed that resources are not infinitely available to all (Ötöker-Robe & Podpiera, 2013).

Our world is experiencing significant environmental problems and we need to take immediate action. One action that has been advocated is education, in particular EE. Considering the environment as an integrated system, EE provides knowledge and develops skills for action. Environmental education is the lifelong process by which people learn to become skillful to live sustainably in the world through positive attitudes and behaviour (UNESCO, 2014).

Given the severity of the impact of human beings on the environment, the role of EE has been recognised as an important factor for achieving natural and social sustainability. Education has been described as foundational for development, peace, economic growth, and responsible global citizenship (UNESCO, 2002). It is also a key contributor to the reduction of inequality and poverty, as it provides the conditions, and generates opportunities, for better, more sustainable societies (UNESCO, 2012). A holistic view of EE and its concern for the natural, socio-economic, political, and cultural dimensions promotes sustainable ways of living by improving knowledge, behaviour and action to address environmental challenges and helps a society to shift toward sustainability (UNESCO, 1977).

The inclusion of EE in the New Zealand school curriculum has in recent years been more directed toward education for sustainability (EfS). Thus, EfS is an approach that is reflected in the New Zealand education system. I discuss the different use of terms in the

next chapter but continue to use EE from this point. While the integration of EE in educational policies has been promoted, its implementation is still only partial, due to some extent to teachers' lack of professional learning in EE (Bolstad, Joyce, & Hipkins, 2015). In order to incorporate EE into the overall education programme, the needs to integrate it into teacher education and provide support for teachers and their professional learning have been recognised as key conditions. Teachers therefore need to be supported through continuing professional learning (UNESCO, 2014).

As highlighted in the literature, TPL is effective when it is ongoing, timely, collaborative, intensive, focused on student learning and conjoined with teaching practice (Beach, 2012; Kuusisaari, 2014; Liu, Miller, & Jahng, 2016; Opfer & Pedder, 2011; Timperley, Wilson, Barrar, & Fung, 2007). Learning, such as TPL, can be viewed as a social activity which occurs within social groups and communities (Lave & Wenger, 1991; Vygotsky, 1978). Technologies that enable social learning, facilitate social interaction, and collaboration have potential to assist in collaborative TPL (Siemens, 2005). The collaborative nature of social media means that they could be used in TPL to provide support and learning opportunities for teachers. For instance, TPL through online communities (Boulton & Hramiak, 2012; Hou, 2015) could use social media to provide ongoing synchronous and asynchronous learning anytime, anywhere (Ross, Maninger, LaPrairie, & Sullivan, 2015), helping teachers to incorporate what they learn into their teaching practices (Ostashewski, Reid, & Moisey, 2011; Sari, 2012; Trust, Krutka, & Carpenter, 2016).

In TPL, the role of social media for collaborative learning and mutual support is growing (Greenhow, Campbell, Galvin, & Askari, 2018; Johnson, Adams Becker, Estrada, & Freeman, 2014; Meabon Bartow, 2014). Despite the popularity of social media among teachers and claims about its potential use for TPL (Bolkan, 2014; Forbes, 2015; Kabilan, Adlina, & Embi, 2011; Kuusisaari, 2014; Ross et al., 2015; Rutherford, 2013), to date there has been little evidence to support its use in TPL in EE.

1.2 Significance of the topic

With growing concern about increasing environmental and sustainability issues, the role of teachers to educate the next generation about sustainability is crucial (UNESCO, 2002). In order to guide students toward the goal of sustainability, teachers need support and professional learning (UNESCO, 2014). However, studies emphasise the lack of

educational support and TPL in EE in the New Zealand context (Bolstad et al., 2015). Given the current lack of formal TPL available in EE, this research suggests opportunities for collaboration and support through social media that may be appropriate aids for teachers to develop professionally in EE. However, the question is whether teachers are already engaged in, or willing to engage in, learning through social media. This makes it essential to understand teachers' perceptions and experiences of professional learning through social media in EE.

Despite the global recognition of the usefulness of social media for learning in general and for TPL in particular, a review of the literature suggests that in New Zealand, there is a dearth of social media research addressing TPL in EE. Specifically, no studies have been published on the utilisation of social media for this purpose in New Zealand. Several studies, mostly in the US context, have reported on TPL through social media in general, pointing out the possibilities and opportunities provided by specific social media platforms for use in TPL. Most of these studies explore the use of Twitter in TPL (Carpenter, 2014; Carpenter & Krutka, 2014; Davis, 2015; Ross et al., 2015; Trust et al., 2016).

The present study is significant for TPL in EE research, as it seeks to understand teachers' perceptions and experiences of professional learning in EE through social media. The research not only seeks a better understanding of the topic but also examines ideas and practical ways to implement the use of social media. The study also seeks to go beyond an investigation of the potential usefulness of a particular social media platform. Thus, the study is useful for providing a full picture of the potential and constraints of social media for learning in general and professional learning in particular in EE.

The possibilities opened up by the use of social media for collaboration are explored through a learning community (See Section 2.3.4.3) for teachers engaged in teaching EfS Achievement Standards¹, determining how teachers engage in a virtual learning community and use social media for their learning in EE. In this way, the findings of this study suggest strategies that could help teachers, schools, or EE stakeholders to design, develop or establish a TPL programme or learning community for EE teachers.

¹ Education For Sustainability subject resources <https://www.nzqa.govt.nz/ncea/subjects/education-for-sustainability/levels/>

1.3 Statement of research questions

To address the objectives of this study, the study is framed by following research questions

Main question

What are teachers' perceptions of professional learning through social media in environmental education?

Sub questions

1. How do teachers, who are engaged in environmental education, use social media in general and in their professional learning in particular?
2. How do teachers, who are engaged in environmental education, perceive their professional learning in environmental education?
3. How do teachers, who are engaged in environmental education, perceive teacher professional learning through social media in environmental education?
4. How does a group of teachers, who are engaged in environmental education, become involved in a professional learning community through social media?
5. How does a group of teachers, who are engaged in a professional learning community, experience professional learning through social media in environmental education?

1.4 My interest and motivation in this study

My interest and motivation in this research are associated with my lifelong career as a geography teacher. Environmental education in my home country, Iran, is mostly integrated into Geography. Learning and teaching geography has connected me to the environment and EE. As a geography teacher, I was aware of, and concerned about, the environment and its worldwide challenges. Not only hearing about environmental problems all around the world, but also observing and feeling many of those issues throughout my life, inspired me to study EE. The objective of EE is to improve knowledge, attitudes, and skills needed to achieve sustainability. Strong sustainability is a combination of a healthy ecosystem, economic development, social justice, equity and democracy. Considering the environment as a system has inspired me to think more deeply and profoundly about the role of education toward sustainability.

The United Nations Decade of Education for Sustainable Development (2005-2014) sought to utilize different educational strategies and resources to help create a more sustainable future (Buckler & Creech, 2014). In this regard, education through Information and Communication Technologies and using the media was proposed (Buckler & Creech, 2014). The change that emergent social media brought to people's lives was always fascinating to me. Social media opened up many ways and channels for people to receive and share environmental news and develop awareness in a more connected and visual way. Studies showed that social media has the potential to be used in informal EE. Therefore, I decided to pursue a Ph.D. in using social media in EE in New Zealand.

I had a number of reasons for conducting EE-based research in the New Zealand context. These included: positive perspectives about the New Zealand education system and the value of EE in its education; my curiosity to learn more about TPL through social media in a country with no censorship; and less political and social barriers and limitations in doing research in New Zealand. In addition, I was not able to pursue my research in my home country as many social media platforms were banned at the time I wanted to start my study (2015). Also, due to its characteristics, EE itself is a complex topic in Iran. Many environmental activists were sentenced to prison in connection with perceived social and political crimes. In addition, teachers are not free to express their ideas or perceptions, especially via social media. Therefore, doing research on using social media for EE in my home country did not seem achievable.

1.5 Overview of the research design

In order to understand and describe teachers' perceptions and experiences of their professional learning through social media in EE, this study employed an interpretivist paradigm. Considering the aims and purpose of the research, phenomenography was employed as the approach to design the study, which was developed in three phases, including several stages and strategies. An overview of the research design is shown in Figure 1.1.

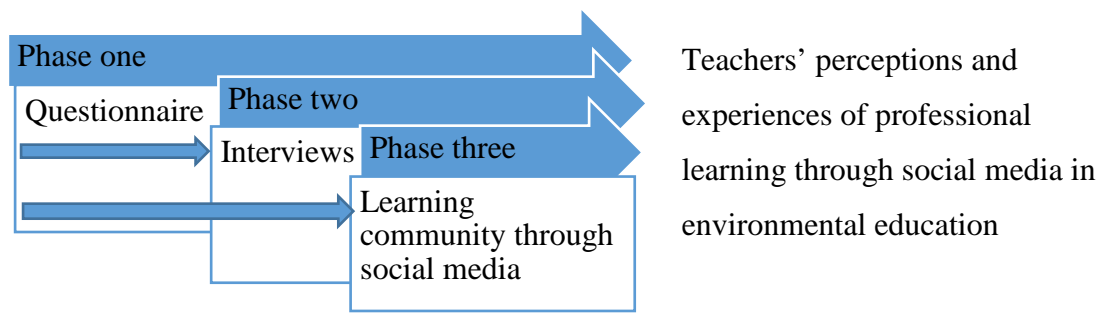


Figure 1.1 Overview of the research design

1.6 Overview of the thesis

The rest of this thesis describes the research process and procedures and includes a variety of research strategies. It is comprised of six further chapters, as outlined below.

- Chapter 2: Literature review

Chapter 2 outlines the literature review and considers the ideas relevant to this study from three subject areas: environmental education, teacher professional learning, and social media for learning, together with social learning theories. The chapter begins with the literature on EE relevant to the study and provides further insight into teacher professional learning in EE within the New Zealand context. Teacher professional learning, both in general and through social media, shape the second section of Chapter 2. The chapter continues with a discussion of the literature on learning through social media and continues with an explanation of the choice of connectivism as an appropriate learning theory to frame the study.

- Chapter 3: Methodology and methods

Chapter 3 outlines the methodology and methods used in the study, including the paradigm underpinning the research, followed by the research approach and design employed. The study process, sampling, data collection, and analysis in three phases are discussed in Chapter 3, as are the process and procedure of data gathering, data analysis and report writing for each phase, together with a consideration of the software to support

the procedures. Ethical considerations also are dealt with in this chapter, which concludes with a discussion of trustworthiness.

Chapters 4, 5 and 6 present an analysis of the findings that emerged through the study. Findings drawn from the first and second phases of the study are reported in Chapters 4 and 5, whereas Chapter 6 is based on the implementation of findings from Phase one and Phase two into the third phase and findings that emerged from the third phase.

- Chapter 4: The participants' background information

Chapter 4 provides background information from EE teachers, such as their characteristics and information regarding their social media usage patterns, their perceptions of EE, as well as teacher professional learning in EE. The chapter builds mainly on findings drawn from the first phase. However, to describe teachers' perceptions of EE and their perspectives on TPL in EE, the findings from Phase two are considered also.

- Chapter 5: Teachers' perception of professional learning and professional learning through social media in environmental education

Chapter 5 describes the findings regarding teachers' perceptions and experiences of professional learning through social media in EE. In addition, the chapter offers an overview of the value of social media to facilitate teacher professional learning, the advantages and challenges of such use of social media, and possible strategies to overcome these challenges.

- Chapter 6: A learning community for environmental education teachers through social media

Chapter 6 describes the way in which findings from the previous phases are used in the third phase. It includes the aims of the third phase and the reasoning supporting it, a discussion of the process and procedure adopted in the third phase, and also reports and interprets the findings of this phase of the study.

- Chapter 7: Discussion, conclusions, and recommendations

The first section of Chapter 7 discusses the research findings which emerge in different phases of the study. The framework of the chapter is based on the main findings of the research sub-questions and on existing literature, and the study's limitations are noted. The final section of the chapter draws conclusions, and implications and recommendations are made for TPL and future research in the area of EE and TPL.

Chapter Two:

Literature review

The literature review chapter in this thesis is divided into three sections with different sub-sections. The first part discusses environmental education (EE). The second section, which involves teacher professional learning (TPL) in general and TPL in EE, is followed by a review of literature on social media for learning and learning theories in the third section. The chapter concludes with a summary and a statement of the framework that guided this study.

2.1 Environmental education

The following literature review informs the position of EE within this study. This section describes EE definitions and approaches. Firstly, the literature on the definition of EE, and the history of EE on an international scale are presented. Then, EE in New Zealand, and education for sustainability in a global context and as well as New Zealand are reviewed. The review then concludes with a discussion of teaching EE and the approach to EE in this study.

2.1.1 Definitions and aims of environmental education

In order to clarify EE and understand its different approaches, a definition of the environment may help. However, there is little agreement among researchers about the term “environment” (Bolstad et al., 2015). The environment can be simply considered as areas with living organisms or places of human activity (Belshaw, 2001). The environment has also been defined as a place which has a mutual relationship with people (Loughland, Reid, Walker, & Petocz, 2003) or as tangible or intangible surroundings (Ministry of Education, 1999).

One of the early definitions of environment by UNESCO (The United Nations Educational, Scientific and Cultural Organization) stated that “the environment can be considered as the whole set of natural and social systems in which humans and the other organisms live and from which they draw their substance” (UNESCO, 1977, p. 1). The distinction made between natural and social systems in this definition allows for consideration of the impacts of social systems upon the environment.

The natural environment is dynamic in itself and is influenced by human interference as it provides resources for humans to pursue their needs. The social system also consists of diverse sub-systems which function in order to satisfy human needs. Therefore, an interaction between the natural and social systems, as two components of a wider system, has existed since humans appeared on Earth. This perspective on the environment as an integrated system is followed in other UNESCO conferences and declarations.

Smyth (2006) claimed that there is a need to define the environment as both a social and a natural system, with mutual interactions between them, as two subsystems of an overall integrated system. Smyth argued that an awareness of the environment as including a social system, with humans as one of its elements rather than apart from the natural system, is important in order to get people to take care of their environment effectively.

The concept of the environment is linked closely with EE (UNESCO, 1977). If the environment is perceived as an integrated system that includes different ecological, social and economic components in interaction with each other (UNESCO, 2002), then EE is the study of the interactions between these ecological, social, and economic systems. Stapp's (1969) early definition of EE saw the environment as a system and emphasized its role in helping humans understand inherent problems, while seeking solutions to these problems. He wrote that "Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (Stapp, 1969, p. 31). According to Palmer (2002), the classic definition of EE adopted by UNESCO in 1970 emphasized the relationship between humans and nature:

Environmental education is a process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among [human], his culture and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulating of a code of behaviour about issues concerning environmental quality. (International Union for Conservation of Nature and Natural Resources & UNESCO, 1970, p. 26)

Environmental education is then a process of learning and exploring environmental issues, natural and social-environmental functions, problem-solving, changing behaviour, and taking action toward sustainability (Gough & Sharpley, 2005). As stated, "Through its work on education for sustainable development, UNESCO aims at reorienting education

so that it gives everyone the opportunity to acquire the knowledge, skills, attitudes and values needed to contribute to sustainable development” (UNESCO, 2014, p. 47).

A study by Schultz, Shriver, Tabanico, and Khazian (2004) has shown that peoples’ attitudes towards, and concerns about, the environment can be related to their view of themselves as part of the environment or distinct from it. Individuals’ perceptions and understanding of the environment, environmental components, and the relationship between humans and the environment also shape environmental behaviour (Yavetz, Goldman, & Pe’er, 2013). As Frantz and Mayer (2014) state, when we regard ourselves as part of the environment and feel connected to it, we may begin to protect it.

Environmental education has its roots in major international documents developed in the 1970’s as charters for EE aims and purposes. As stated in the *Belgrade Charter* (UNESCO, 1976), the aim of EE is not only to improve knowledge but also to enhance skills to take action toward sustaining the environment. It explained that the goal of EE is “to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills and attitudes, motivation and commitment to work individually and collectively towards solutions to current problems and the prevention of new ones” (UNESCO, 1976, p. 2). Following this, the *Tbilisi Declaration* highlighted EE purposes as the following:

A process during which individuals and the community are made aware of their environment, and of the interaction of its biological, physical, socio-cultural and economic components, and acquire the knowledge, values, skills, experience and also the will to enable them to act, individually and collectively, to solve the present and future problems of the environment (UNESCO, 1977, p. 13).

This goal is further broken down into a set of EE objectives (UNESCO, 1977, pp. 26-27) as follows:

- Awareness: to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems and/or issues
- Sensitivity: to help social groups and individuals gain a variety of experiences in, and acquire a basic understanding of, the environment and its associated problems and/or issues

- Attitudes: to help social groups and individuals acquire a set of values and feelings of concern for the environment and motivation for actively participating in environmental improvement and protection
- Skills: to help social groups and individuals acquire skills for identifying and solving environmental problems and/or issues
- Participation: to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems and/or issues

Environmental education thus aims to change an individual's knowledge to influence their environmental behaviour (UNESCO, 1977, 2002). In this process, deeper understandings of the environment and environmental issues lead individuals to improve their environmental behaviour and skills enabling them to take environmental action, which can lead individuals and communities to become environmental stewards and work with other individuals or groups to achieve sustainability (UNESCO, 2005).

Our environment is fragile, with limited resources. People need to be aware of these limitations in order to take care of the environment by making right decisions and preventing environmental problems. As presented in the *Tbilisi Declaration*, different terms are used to discuss the objectives of EE. Environmental awareness probes around understanding the role of environmental components in the environmental system as well as environmental threats and issues. Awareness is “the first step towards the systemic way of thinking” (Smyth, 2006, p. 250). Environmental awareness therefore aims to promote sensitivity to environmental changes and to understand the importance of protecting different elements of the environment as a system. To educate responsible citizens who actively participate in protecting the environment, enhancing environmental awareness both formally and informally is the first step in EE. For teachers, interactions with other teachers and experts through social media can generate awareness of such issues (Finch et al., 2016).

While environmental awareness is linked to the consciousness of present environmental issues and the problems associated with these challenges, environmental knowledge can develop an understanding of the different aspects of the environment and can be included in the realization of the environmental elements, environmental problems, and the causes and consequences of these issues (UNESCO, 1976). Environmental knowledge therefore involves information about the environment and its associated problems, as well as the

human impact on the environment. Jensen (2002) has stated that knowledge development is a major factor in EE if it is in line with other EE goals and objectives. To him, the aim of improving environmental knowledge is enhancing environmental behaviour. In this regard, he has considered four learning dimensions involved in environmental knowledge, including: knowledge about causes and effects of environmental issues; knowledge about strategies for change; knowledge about alternatives; and visions for the future. As Jensen (2002, p. 331) suggested, “knowledge about other possibilities can be a powerful source of inspiration for developing one’s own visions.” Therefore, to develop new and alternative visions, knowing about other cultures and places is important in environmental knowledge development.

Alongside knowledge, environmental attitudes are also foundations in EE towards identifying environmental problems and helping to resolve environmental challenges. The *Tbilisi Declaration* states that EE aims to help individuals and social groups develop environmental attitudes in order to cultivate a set of values and feelings concerning the environment and the motivation for actively participating in environmental improvement and protection. Some of the attitudes regarding the environment and environmental issues are often shaped by accepting the values and behaviours of the majority through social interactions (Kollmuss & Agyeman, 2002). An individual becomes influenced by previous philosophies, ideas, and perceptions which are learned formally and informally. Media also play a key role in this process (Kollmuss & Agyeman, 2002).

Values are the most important aspect shaping environmental attitudes and subsequent behaviours (UNESCO, 1977). People’s environmental decisions and choices are influenced by their values. An individual’s values, which develop from childhood and are conveyed through life, are shaped and influenced by a variety of sources, such as family, schools, social groups, media and social institutions and organizations (Kollmuss & Agyeman, 2002). Also, some environmental values can be influenced by the education system. Students should therefore be encouraged to consider their own environmental values through education. One of the main concerns in teaching environmental values to students is that teachers’ values might reflect in their teaching (Tilbury, 1995). Teachers need to consider that EE “is not limited to teaching about values, but extends to the teaching of values” (Tilbury, 1995, p. 201).

To address environmental problems, awareness, knowledge, and positive values are essential but not sufficient. Individuals need to be conversant with required skills in order to be able to act against environmental problems and move toward sustainability (Wals, 1990). Responsible environmental behaviour is a key goal of EE (Heimlich & Ardoin, 2008). Gough (2013) clearly demonstrates that behavioural change toward the environment is the main focus in EE research. To support this view, she cites studies by Howe and Disinger (1991), Hungerford and Volk (1990), and Stapp (1969). Encouraging environmentally responsible behaviour is also identified as the main EE goal in the studies by Fien (1993) and Simmons (1991). Environmentally responsible behaviour requires not only awareness and knowledge of environmental systems and positive attitudes toward the environment, but also involves practical knowledge of how to take action as a responsible citizen (Athman & Monroe, 2001). Therefore, achieving environmentally responsible behaviour emphasizes knowledge and behavioural development in line with decision making and working collaboratively in holistic ways for the environment.

Human interactions with the environment have resulted in environmental degradation, which needs correction by individual and social action (Jensen & Schnack, 2006). Therefore, EE is not only concerned with changing human behaviour toward the environment through wider understandings of environmental aspects and interaction, but seeks to raise capable individuals able to participate and take action to solve environmental problems (Jensen & Schnack, 2006). Such learning could change the current unsustainable processes towards the environment and lead to a more sustainable world.

The perspective on EE in this thesis is similar to that of the *Tbilisi Declaration*, which emphasises EE as a learning process incorporating awareness and action. Awareness includes factors such as knowledge of environmental sciences, and understanding attitudes and values toward the environment. Environmental action includes practical skills and participation in environmentally constructive activities. To achieve sustainability, students should be exposed to environmental issues, learn about environmental components and their characteristics and contribute to environmental actions which help them to think wisely and make decisions toward sustainability. In this regard, I agree with Bolstad's (2003) statement that the goal of EE, which is education for students' future, is not only to teach how to address symptoms of environmental

problems, but to teach students how to be active participants in order to find sustainable solutions for both the social and ecological problems facing our environment.

2.1.2 *The history of environmental education*

The contemporary environmental movement began in the 1960's and 1970's as a result of a range of environmental concerns and events (Brulle & Rootes, 2015; Buttel, 1975). The environmental movement was stimulated by the book *Silent Spring* (Carson, 1962) as one key influence which brought to light growing concerns about environmental degradation (Brulle & Rootes, 2015). These concerns created the challenge of how to address them. Environmental education as a response to these challenges started in the 1960's and 1970's with UNESCO conferences and declarations. The International Environmental Education Programme (IEEP) was launched in 1975 (Blackburn, 1983). The *Belgrade Charter* first offered guiding principles for EE (UNESCO, 1976), which were then refined in the *Tbilisi Declaration* (UNESCO, 1977). The *Tbilisi Declaration* provided environmental education's framework, and guideline principles at the local, national and international level. The *Tbilisi Declaration* also highlighted the role of informal learning alongside formal education, and also emphasised the significant role of regular and up to date TPL in EE.

Despite a comprehensive EE framework and guiding principles launched by UNESCO in the 1970s, not only did the global environmental challenges still exist a decade later but these challenges had grown. Added to that, the need for economic development to address poverty, on one hand, and natural environmental protection, on the other, was a major concern for the United Nations (UN). To meet this challenge, in the 1980s the *Brundtland Report* identified the need for sustainability in development (Brundtland et al., 1987). Considering the world as a system, the Brundtland Commission was established to unite all nations to pursue sustainability. In response to environmental degradation and the role of humans in increasing environmental issues, *Agenda 21* from the United Nations Conference on Environment and Development (the Earth Summit) also highlighted the role of governments along with all sectors of societies towards integrating environmental issues into education as a multidisciplinary approach (Johnson, 1993; Sitarz, 1993). Toward this end, *Agenda 21* stated a new vision for EE:

Education, including formal education, public awareness and training, should be recognized as a process by which human beings and societies can reach their fullest potential. Education is critical for achieving environmental and ethical awareness, values and attitudes, skills and behaviour consistent with sustainable development and for effective public participation in decision-making. Both formal and non-formal education are indispensable to changing people's attitudes so that they have the capacity to assess and address their sustainable development concerns. (United Nations, 1992, Chapter 36)

Also, in regard to an attempt to find a new bearing which could help humanity toward sustainability, the Earth Summit in Rio de Janeiro in 1992 suggested reorienting education. It was suggested that education must reflect the vision of sustainability (UNESCO, 1992). As environmental degradations affect both the natural environment as well as society, 10 years later the Johannesburg Summit 2002 on sustainable development called for global actions towards sustainable development (Speth, 2003). With a growing consensus about the need for education towards sustainable development, *Agenda 21* had highlighted the role of governments in line with all sectors of societies toward integrating environmental issues into education as a multidisciplinary approach (UNESCO, 2002). In response to this call, many governments, including the New Zealand government, have implemented EE policies since the 1990's (Bolstad et al., 2004).

As noted earlier, in 1987 the *Brundtland report* emphasized the essential role of social, political and economic circumstances in development (Brundtland et al., 1987). Considering the role of social groups in development, the concept of sustainability emerged in the 1980's and was established collectively in the 1990's (Tilbury, 1995). Since then, the term EE has gradually been replaced internationally by the term Education for Sustainable Development (ESD) and in some countries by Education for Sustainability (EfS) (Bolstad, 2003; Tilbury, 1995). As UNESCO indicated, "Education for sustainable development is an emerging but dynamic concept that encompasses a new vision of education that seeks to empower people of all ages to assume responsibility for creating a sustainable future" (UNESCO, 2002, p. 5).

Bolstad et al. (2015) have explicated the connotations of different terms in the field of EE and the particular educational approaches involved with these terms. They describe EE as "a broad range of student learning activities in, about, and for the environment, often with an emphasis on students' interactions with and understanding of the biophysical

environment” (p. 2). In contrast to EE, the notion of EfS has been termed “a more integrative, critical educational approach that additionally focuses on the social, economic, cultural, and political patterns and contexts that shape human interactions with the biophysical environment, and foregrounds the goal of critically informed action as an outcome of EfS” (Bolstad et al., 2015, p. 2). The characterization of ESD/EfS is controversial, however, because the concept of development is not well-defined and each country’s interpretation of EfS is different (Räthzel & Uzzell, 2009). Despite different interpretations of EfS and the scholarly debates involved, since the 1990’s EfS has become an accepted term in the field of EE to describe the role of education to lead societies to sustainability. Although the next discussion uses EfS as a term to reflect this movement, some interchangeability between EE and EfS is appropriate, until one term is chosen as reference for the rest of this thesis in Section 2.1.5 below.

For decades, choosing between the environment and development was an international dilemma. As UNESCO (1977) pointed out, the conflict between the environment and sustainability is due to failing to define “environment” and development fully. Development and environment can complement each other, where development causes socio-economic growth which results in social improvement against poverty. The sustainability of the environment is regarded as an essential part of development. In this regard, UNESCO identified a series of objectives which are incorporated into sustainability, including “the satisfaction of basic human need, improvement of living conditions, the continued promotion of development, respect for limitations of the planet’s biosphere, the rational management of resources and consideration for the need of future generations in the undertaking of activities” (UNESCO, 1977, p. 4).

Fifteen years later, UNESCO (1992, p. 2) emphasised humans as the centre of sustainable development, where humans are “entitled to a healthy and productive life in harmony with nature”. It also clearly mentions that “in order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it” (p. 2). According to the *Brundtland Report* (Brundtland et al., 1987), “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Chapter 2, para. 1). However, as highlighted in Chapter 1, the reality in the contemporary world is different from sustainability goals in a number of respects.

The role of education as one of the main points of the sustainable development concept was defined by *Agenda 21*, attempting to establish the connection between education and sustainable development (United Nations, 1992). Education plays a key role in sustainable development through changing attitudes and dispositions affecting people's behaviour towards the environment (UNESCO, 2014). As mentioned, the concept of sustainable development is not a simple and well-defined notion, and there is a lack of a universal structure to measure sustainable development (Manteaw, 2012). These confusions have made it difficult for most countries to use the concept to develop a philosophy in order to inform educational thinking and practice toward sustainability (Manteaw, 2012).

However, the relationship between three factors, ecological, social, and economic, is the main concern in EfS. This involves life-long learning in all social contexts to raise responsible citizens globally and locally. Moreover, EfS promotes democracy by allowing individuals and communities to enjoy their rights and accomplish their responsibilities towards the environment (UNESCO, 2002, 2005). One of the greatest concerns in EfS is to construct a relationship between the environment and society as an integrated system on a global scale. As people are part of the environment and human activities have a major impact on it, EfS promotes two key ideas. First, learning helps us to develop our understanding of natural systems, their components, and the relationships between these systems and humans. Second, sustainability is one of the main factors that can maintain our environment. Education for sustainability, therefore, is important for promoting sustainability and improving people's ability to address environmental issues.

Following *Agenda 21* (UNESCO, 1992, p. 2), which emphasized the role of action in EE, many scholars highlighted the impact of promoting action competence in sustainability. Jensen and Schnack (2006) were early scholars who defined action competence associated with EE. Their emphasis was placed on environmental concerns as well as the role of education to promote and facilitate the ability to act on social and natural environmental issues. It is evident from their definition that students' development in action competence leads them to take part in democratic practices regarding the environment. They argued that students' ability and willingness to contribute in a democratic society improve through using an action competence approach in education.

Action competence and behaviour modification are two fundamental goals for EE. However, from the earlier definition, action competence was distinguished from behavioural changes in EE. Breiting and Mogensen (1999) argued that “the action competence approach is related to developing a critical, reflective and participatory approach” (p. 350) based on students’ understanding and choices, while students’ behavioural change aims at prescribing certain environmental behaviours based on teachers’ choices. Similarly, Tilbury (1995) claimed that EE prompts action by challenging individuals to change their lifestyle to a sustainable method and take responsibility in a democratic society. To elaborate this view, and in line with Hungerford and Litherland’s (1986) perspective, she characterized environment-related actions into six types, including negotiation, persuasion, consumerism, political action, legal action, and eco management. Tilbury also believed that in order to develop action competence, the role of teachers is critical to inform students of different environmental actions and their consequences.

The next sub-section details how New Zealand took its cues from this international context for EE.

2.1.3 Environmental education in New Zealand

New Zealand’s EE policy and framework has been influenced by the international declarations and conferences. From the 1990’s, the New Zealand government introduced developments in EE to the school curriculum. Environmental education in New Zealand policy could be seen to have started with the establishment of directives regarding EE by the Ministry of the Environment in the 1990’s. At this time, first the Ministry for the Environment, then the Ministry of Education, established strategies on EE (Ministry for the Environment, 1998; Ministry of Education, 1999).

In 1993, the New Zealand Curriculum Framework was released laying out educational principles and policies in New Zealand. The Framework involved the national government’s key education policies. Seven learning areas, including the arts, language, mathematics, health and physical well-being, science, social sciences, and technology, were covered by the Framework. The subject of EE, however, was identified as non-mandatory and was based on local needs and priorities. While the New Zealand Curriculum Framework of 1993 (Ministry of Education, 1993) did not make formal

provision for EE in the school curriculum, it accommodated diverse indigenous needs and priorities in such a manner that environmental concerns could not be ignored (Dowling, 1993; Eames, Cowie, & Bolstad, 2008). Since then, some notable developments were achieved through different strategies and guidelines, including the development of *Learning to Care for our Environment* (Ministry for the Environment, 1998), the publication of the *Guidelines for Environmental Education in New Zealand Schools* (Ministry of Education, 1999), the introduction of the Enviroschools programme in 2001, and the establishment of *The New Zealand Curriculum* (Ministry of Education, 2007).

In 1998, the Ministry of the Environment established a position which aimed to include EE throughout the school curriculum (Ministry for the Environment, 1998). *Learning to Care for our Environment* was published in 1998 as a discussion paper by the Ministry for the Environment in collaboration with the Ministry of Education, and aimed to contribute to the development of a national strategy for EE. This strategy emphasised the critical role of education to help people to play their part toward sustainability. Environmental education was seen and described as lifelong learning through formal and informal education and was defined as “a multi-disciplinary approach to learning that develops the knowledge, awareness, attitudes, values and skills that will enable individuals and the community to contribute towards maintaining and improving the quality of the environment” (Ministry for the Environment, 1998, p. 9). Toward this end, the national strategy highlighted the need for formal and informal EE for all people and all ages.

Following the national strategy, in 1999, the *Guidelines for Environmental Education in New Zealand schools* was published by the Ministry of Education (Ministry of Education, 1999). Environmental education objectives, which had been identified in the *Tbilisi Declaration*, provided strategy and mechanisms to achieve EE goals. In line with the *Tbilisi Declaration*, the New Zealand guidelines identified EE goals as awareness and sensitivity to environmental issues, knowledge and understanding of the environment and its components and the impact of people on environment, attitudes and values concerning environment, skills to identify environmental challenges in order to help and resolve these challenges, and participation and action toward sustainability. The *Guidelines* created paths for the expansion of EE teaching and learning programmes in the New Zealand education system and suggested opportunities to incorporate EE into the school

curriculum. The *Guidelines* offered opportunities for connecting EE to the seven essential learning areas of the curriculum to develop student education. These included skills in the areas of *communication, numeracy, information and problem-solving*, as well as *self-management and competitive skills, social and cooperative skills, physical skills, and work and study skills* (Ministry of Education, 1999). The *Guidelines* identified the four main principles that should support EE as *interdependence, sustainability, and biodiversity*, as well as *personal and social responsibility for action*. To reflect the ancient vision of sustainability and the significant position of the indigenous people of New Zealand (the Māori), the *Guidelines* also made provision for combining Māori worldviews into these concepts.

As indicated in the *Guidelines*, to address environmental challenges raising awareness of environmental issues is essential but insufficient. Personal and social participation in the form of taking action against environmental issues and toward sustainability is needed. The *Guidelines* specified that multidisciplinary teaching and learning approaches are required to meet the purposes of EE. Environmental education was identified as education *in* the environment, education *about* the environment, and education *for* the environment, as three required dimensions. In *education for the environment*, EE goals consisted of going beyond being knowledgeable about the environment and its issues. It extend into environmental concern and required skills to resolve environmental problems. The *Guidelines* encouraged cooperation and integration and promoted an open school curriculum approach in which teachers and school leaders, with the help of the Ministry of Education, are able to plan and provide education *in, about, and for* the environment, based on local needs and priorities. The support of the *Guidelines* as New Zealand EE policy means that the school curriculum can support students toward sustainability. As clearly highlighted in the guidelines, education for sustainability was the focus for education in New Zealand.

Towards the end of the 20th century, EE has taken a more definite direction internationally, due to the development of theory, practice, and research in this field. In the New Zealand context, EE moved in the direction of education for sustainability in policy. Thus, from this point onwards and for the purpose of sustainability, EfS is considered as the common approach in the New Zealand education system. The imperative need for EfS is recognized in the New Zealand education system and

highlighted by the Ministry of Education in their statement that “EfS includes learning about the environment, water, land, ecosystems, energy, waste, urban living, transportation; the interactions between the natural environment and human activities, and the consequences of these; the choices and actions we can take to prevent, reduce, or change harmful activities to the environment” (Ministry of Education, 2016a, p. 2). Towards a sustainability approach in the New Zealand school curriculum, education is to “continue to develop the values, knowledge, and competencies that will enable them (students) to live full and satisfying lives” (Ministry of Education, 2007, p. 8).

The New Zealand Curriculum (NZC) was introduced to the education system in 2007. While the NZC put renewed emphasis on languages, statistics, and information and communication technology, it has also highlighted the importance of EfS in line with international standards within the field of education. Sustainability therefore is a key theme in the NZC (Ministry of Education, 2016a), and is integrated into its vision, values, and principles. The curriculum also gives emphasis to the interdisciplinary role of EfS across the eight learning areas and their contexts: English, the arts, health and physical education, languages, mathematics, science, social sciences, and technology (Ministry of Education, 2016a). The NZC implies that EfS enables students to contribute to a sustainable future by being connected to their environment. It also encourages New Zealanders to take the opportunities obtainable through new knowledge and technologies to protect a sustainable social, cultural, economic, and environmental future (Ministry of Education, 2007). A key aim is raising citizens who are connected to the environment and are able to engage effectively towards sustainability in local and international communities.

To this end, action competence is also emphasised as an educational approach in both the *Guidelines* and the Ministry of Education web material. The Ministry of Education defines action competence as “the choices and actions we can take to prevent, reduce, or change harmful activities to the environment” (Ministry of Education, 2016a). Action competence is explicated further as “having a broad range of competencies to guide appropriate action, and the ability, attitudes and values, willingness and opportunity to act. Therefore, the focus is grounded in intentional actions which do something to achieve better outcomes for the environment and sustainability” (Eames, Barker, Wilson-Hill, & Law, 2010, p. 2). In this way, action competence can support students’ lifelong learning

and contribution to society. Action competence, therefore, includes attitudes, and values which lead people to act sustainably and willingly (Ministry of Education, 2016a, 2016b).

In line with an action competence approach in EE, education *for* the environment is promoted in New Zealand education. In education *for* the environment, students learn to work towards the resolution of environmental issues. Education *for* the environment, therefore, aims to enhance the quality of the environment by improving students' knowledge, awareness and values toward the environment (Barker & Rogers, 2004). Considering the sustainability approach in the New Zealand school curriculum, a whole school approach toward sustainability was also recommended in the New Zealand education system in the 1990's (Jackson, 2009). However, the position of EfS within current policy results in varying implementation of EE practices in New Zealand schools. This ranges from little or no EfS in some schools to advanced programmes such as Enviroschools (Eames et al., 2008).

2.1.4 The Enviroschools Programme

The Enviroschools national programme started in the 1990's in Hamilton City and has grown nationally since 2002, initially under the New Zealand Association for Environmental Education (Jackson, 2009). The programme initially started as an eco-schools model in 1993, and then changed its name to Enviroschools. The Enviroschools programme aimed to support sustainability, which had been highlighted by UNESCO through promoting the notion of Education for Sustainability (EfS). It is a whole school approach that aims to promote and support sustainability through learning, commitment and taking action with respect to the environment (Eames, 2010). Sustainability in lifestyles and education processes are encouraged through this programme. Enviroschools emphasizes the role of learning communities, student engagement, community partnerships, and sustainable school practices through integrated learning approaches (Enviroschools, 2016). In terms of community involvement, it also draws on educational knowledge from Māori perspectives, inspired by *Agenda 21* (Eames, 2010). It has been shown that the goals of the Enviroschools Programme are aligned with EfS, and that it could be a successful model to be used in education toward sustainability (Eames, 2010).

The Enviroschools Programme aims to provide an effective EfS learning approach in New Zealand schools. Enviroschools seeks to develop an ecological systems approach

toward sustainability by developing “a cultural shift in education from a focus on prescribed outcomes to a holistic, dynamic view of education that requires connectedness across the curriculum, schools and their communities” (Eames, 2010, p. 3). A number of practical and cooperative professional learning initiatives have been offered under the Enviroschools programme (Eames, Roberts, Cooper, & Hipkins, 2010), which could guide future professional learning in EfS. As the Enviroschools programme is supported by different partners, such as local government and non-governmental organizations (NGO), collaboration and networking between teachers, environmental organisations, and other contributors are a key feature of the programme (Enviroschools, 2016).

To recap, EE in New Zealand is promoted as cross-curricular learning. The NZC indicates that it can be seen as a multidisciplinary theme across the eight areas of the curriculum. EE is also supported by major stakeholders, including the Ministry of Education, the Department of Conservation and the Ministry for the Environment (Bolstad et al., 2015). These stakeholders contribute to the shared goal of EE and cooperate to develop different programmes to engage students in EE actively.

However, as the study by Bolstad et al. (2015) concluded, although the NZC offers an educational framework, EE practice varies in New Zealand schools, based on “teachers’ knowledge and confidence, the degree of access to EE support and resources, the values and priority assigned to EE by teachers and by the school” (Bolstad et al., 2015, p. 13). This is partly due to the dearth of tertiary education in EE available for teachers who are engaged in EE (Bolstad, Eames, & Robertson, 2008). A study by Eames and Barker (2011) also highlighted the lack of support for in-service teachers as one of the challenges to implementing EE in New Zealand schools. Teachers need learning support in terms of content knowledge with regard to environmental and sustainability issues (Çalik & Eames, 2012). Teacher professional learning opportunities in EE could therefore have a significant impact on the success of EE in New Zealand schools (Dada, 2018).

2.1.5 Teaching, teachers and environmental education

Environmental education is a holistic and interdisciplinary approach, with teachers and schools playing a critical role in its implementation and success (Bolstad, 2005). Although environmentally responsible behaviour and action toward sustainability are clarified by UNESCO as the main goal of EE, first students’ knowledge, awareness, and

values regarding the environment need to be enhanced. Then, students may change their behaviour accordingly. Environmental knowledge, awareness, and values, therefore, are the basis of action taking or action competence in EE. However, determining appropriate information and knowledge to enhance students' awareness and knowledge in EE can be a challenging decision for teachers, and some teachers are also unfamiliar with EE pedagogy (Eames et al., 2008). As teachers have a key role in guiding their students in developing action competence, in order to have an effective and productive EE programme, scholars have argued that teachers' knowledge and skills development is number one priority in education (Marcinkowski, Volk, & Hungerford, 1990; Nath, 2009; Robertson & Krugly-Smolska, 1997).

Although teachers can be willing to offer effective EE programmes, their lack of knowledge and teaching skills in EE have limited their practice (Cowie & Eames, 2004). In addition, teachers are usually constrained by a busy schedule (Timperley et al., 2007), which may limit their practice in environmentally related projects (Cowie & Eames, 2004; Robertson & Krugly-Smolska, 1997). The impact of teaching methods on successful EE programmes has been studied by Kostova and Atasoy (2008). In line with a focus on effective teaching and learning methods, they emphasise the role of active learning in EE. They claim that student engagement in learning when they try to find the solution for a certain problem, is the most effective teaching method in EE. They pointed out that teachers' knowledge and behaviour is insufficient to improve students' attitudes or encourage their action taking toward a sustainable environment. Teachers need to provide support and facilitate student learning through the process of obtaining required knowledge and skills.

Kostova and Atasoy (2008) have also claimed that collaboration, whether between teachers or students, is required to adopt and implement innovative methods for effective EE programmes. Later, this idea was further elaborated by Derevenskaia (2014), who pointed out that active teaching methods afford interaction between students and teachers when students participate in the process of learning, for example by contributing to a related EE project. However, in order to contribute to effective EE methods or to encourage students to do so, teachers should have a good understanding of the subject matter (Nath, 2009). Kostova and Atasoy (2008) also claim that knowledge is dynamic, and therefore, education is a lifelong process of acquiring and applying knowledge.

In the New Zealand context, despite a series of guidelines and curriculum developments which emphasize the role and position of EE in education toward sustainability, schools face some challenges to implement formal EE and promote involvement in integrating EE into their curriculum. Teachers' lack of confidence and skills to plan EE in an integrated way, and time, budget and information limitations have restricted EE practice in New Zealand schools. In addition, overloaded schedules, especially in secondary schools, may prevent teachers from integrating EE into the school curriculum (Cowie & Eames, 2004, pp. 20, 21). Eames et al. (2008, p. 45) stated that some teachers saw EE as a burden, being part of the 'over-crowded curriculum' which is more evident in secondary than in primary schools. "Even though there is scope within the NZC for individual teachers or whole schools to integrate EE within and across the school curriculum" (Bolstad et al., 2015, p. 42), teachers and schools' involvement in EE is still limited by teachers' lack of awareness of an EfS approach in New Zealand education and lack of confidence to implement sustainability in education (Bolstad et al., 2015). Thus, as Bolstad et al. (2015) pointed out, there is a link between TPL and the development of effective EE practice in New Zealand schools.

2.1.6 Environmental education as a term in this study

Although different terms like EE, ESE (Environmental and Sustainability Education), ESD (Education for Sustainable Development) and EfS are used in the literature in this field of research, this study intends to use the term EE from here on. EE can be seen as an umbrella term used by many authors in this field. Unlike other terms which centre on development or an end goal, EE has an inclusive nature which emphasises the interaction between environment and society. Therefore to avoid misinterpretation, use of EE in this research incorporates a broad range of approaches to the environment, as reflected in the New Zealand curriculum (Ministry of Education, 2016b). Environmental education is therefore an appropriate term, as teachers are familiar with it and are likely to recognize many other concepts which are included in EE.

2.1.7 Section summary

Environmental education considers the environment as an integrated system based upon the interactions between natural and social systems. With a large variety of components making up the environment, any changes to one part of the environment impact upon

other parts. Environmental education offers the development of knowledge and skills towards sustainability. Sustainability is also emphasized in EE as a focus for natural and social environments.

As sustainability is an approach in the New Zealand education system, the importance of EE and the need for it are recognized in the NZC. Environmental education is cross-curricular learning across all educational settings in the New Zealand context. Although EE can be a multidisciplinary theme within eight learning areas, its practice varies in New Zealand schools. Schools also face some challenges in integrating EE into their curriculum. In order to improve EE in schools, the role of teachers is critical. Therefore, there is a significant link between TPL and effective EE practice.

2.2 Teacher professional learning

This section presents an overview of the literature related to TPL in six sub-sections. The first part is concerned with TPL approaches. Then, literature regarding teacher collaboration, collaboration in a professional learning community, and online communities as a new source of professional learning are reviewed. This section also reviews the literature on TPL for 21st century learning and TPL in EE. Finally, some relevant studies regarding TPL in EE are presented. The section is then concluded with a summary.

2.2.1 Teacher professional learning approaches

The teaching profession is continuously changing in relation to new technology, pedagogies and content areas (Admiraal et al., 2016; Education Council, 2016). To develop the quality of teaching and enhance learning, professional learning has been recognized as a significant need and responsibility for teachers (Owen, 2014; Van Schalkwyk, Leibowitz, Herman, & Farmer, 2015). Effective TPL facilitates teachers' ongoing development of their knowledge and skills to gradually enhance teaching methods (Admiraal et al., 2016; Labone & Long, 2016). Teaching practices have a significant influence on students' learning and achievements (Admiraal et al., 2016; Labone & Long, 2016). Considering the significant role of TPL and its different methods, this section focuses on the different approaches underpinning TPL.

The literature on TPL has highlighted several approaches, based on features and forms of teacher learning activities. Beck and Kosnik (2014) identified four professional learning approaches for teachers: formal learning, informal learning, teaching as inquiry, and school-based professional learning.

Formal professional learning takes place through courses, seminars, and workshops. It has been argued that directing teachers to a specific type of formal professional learning improves teaching practice (Grigg, Kelly, Gamoran, & Borman, 2012), since such learning offers teachers new knowledge, skills, ideas and teaching approaches (Timperley et al., 2007).

Most formal TPL programmes are scheduled as workshops or events (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). The New Zealand Post Primary Teachers' Association (NZPPTA), reported that teachers value one-off workshop opportunities to enhance their knowledge in particular areas (NZPPTA, 2013). Participants in research on the professional learning of academics for their teaching role believed that [structured programmes, such as a series of workshops], were effective in improving their teaching methods (Van Schalkwyk et al., 2015, p. 8). A study which evaluated the effect of both informal and formal science, technology, engineering, and mathematics (STEM) courses on pre-service teachers indicates that their participation in the courses resulted in improving both their pedagogy and content knowledge, as well as their self-efficacy (Stokes, Evans, & Craig, 2017). The authors also argued that as a result of the courses, pre-service teachers learned how to implement inquiry-based learning in the classroom.

However, guiding teachers to the most suitable formal professional learning opportunities to improve their teaching practice and foster student learning is one of the main challenges in TPL (Brooks & Gibson, 2012). It is argued that traditional professional learning methods, such as short courses or one-off sessions, may not be effective in changing teaching practices and increasing student learning outcomes (Mansfield & Thompson, 2017; Thacker, 2014), since they may be disconnected from the complexities of the classroom (Opfer & Pedder, 2011).

In contrast, “informal learning is more prevalent in the workplace and potentially more effective than formal professional learning” to change teaching practice (Thacker, 2014, p. 4). Informal learning is unbounded and occurs in the teachers' daily lives and career progression, including discussions among colleagues, observation of other teachers'

practices, self-learning, collaborative learning (Timperley et al., 2007), and self-improvement through virtual materials and resources (Mizell, 2010). Informal learning has been recognized by some scholars as teachers' preferred method of professional learning (Beck & Kosnik, 2014). It has been suggested that because teachers have busy schedules and some professional learning programmes do not suit their needs, informal TPL provides an opportunity for them to engage in professional learning that can best improve their knowledge and practice (Beach, 2012; Lom & Sullenger, 2011).

Much informal learning can occur in the classroom, when teachers face new situations and challenges in adjusting to students' abilities and requirements (Beck & Kosnik, 2014). This is aligned within Teaching as Inquiry in the NZC. The process of Teaching as Inquiry enables teachers to analyse student achievement in order to identify students' learning needs, find solutions and improve teaching practice (Ministry of Education, 2007). As highlighted in the Teaching as Inquiry approach, knowledge and skills development are essential requirements for teachers to guide students with a wide range of different abilities and diverse learning needs (Timperley et al., 2007). According to the NZC, in many New Zealand schools systems of support and collaborative learning throughout schools have made the process of teaching as inquiry more successful (Ministry of Education, 2016c).

When teachers work collaboratively on understanding the teaching as inquiry process and put it into practice, students' needs are well defined and many possible strategies are considered to help overcome teaching challenges (Timperley et al., 2007). A school-based TPL approach, in the form of a learning community (See Section 2.3.4.3), is therefore highlighted in the literature because it promotes opportunities for both development and practice simultaneously (McLaughlin & Talbert, 2006). Accordingly, TPL is considered to be more effective when teachers from the same school, who engage in teaching at the same year level or in the same subject area, work together (Garet, Porter, Desimone, Birman, & Yoon, 2001; Opfer & Pedder, 2011; Wayne, Yoon, Zhu, Cronen, & Garet, 2008). This implication has challenges for EE teaching in New Zealand, where often a single teacher at a school is involved, or at least takes primary responsibility.

2.2.2 Teacher collaboration

Collaboration is defined in a variety of ways. The study by Rakhudu, Davhana-Maselesele, and Useh (2016) describes a range of definitions in different contexts. The authors adapted Mfum-Mensah (2011) definition of collaboration in education: collaboration occurs when “two or more equal individuals voluntarily bring their knowledge and experience together by interacting towards a common goal in the best interest of students for the betterment of their educational success” (Mfum-Mensah, 2011 as cited in Rakhudu et al., 2016, p. 4).

Collaboration offers an effective learning environment and may help teachers to develop their knowledge (Vygotsky, 1978) and sustain their learning (Kuusisaari, 2014). Collaborative learning for teachers can reduce feelings of isolation (Plauborg, 2009). Teachers may then feel motivated and supported by colleagues in the process of learning and the application of this learning to teaching practice (Opfer & Pedder, 2011). As Kuusisaari (2014, p. 55) concluded, peers “are able to support and carry out meaningful and creative collaborative development by revising presented ideas and questioning the developed constructions”. Experienced peers or experts can therefore help newer teachers to develop their knowledge and teaching practice (Vygotsky, 1978). Peer to peer collaboration may also take the form of discussion between teachers who have the same experience and who are engaged in the same subject area (Kuusisaari, 2014). Teacher collaboration can have value through activities such as working with colleagues, observing lessons, and sharing ideas and knowledge (Cameron, Mulholland, & Branson, 2013).

Mansfield and Thompson (2017) studied the value of collaborative TPL in Australia. They reported that from teachers’ perspectives, collaboration was valuable. These findings are aligned with a previous study by Darling-Hammond et al. (2009), which highlighted the benefits of collaborative TPL in the United States and some other countries, including New Zealand. The authors concluded that collaborative TPL could create changes in teacher practice because this kind of learning would endure longer, which in turn could improve student achievement. In a study conducted by Admiraal et al. (2016, p. 291), which focussed on secondary school teachers in the Netherlands, the affordances of collaborative TPL were described as “sharing teaching practices and knowledge, collaborating on design, and observing and evaluating other teachers’

practices”. Admiraal et al. (2016, p. 291) claimed that observing other teachers’ practices “might help teachers to take different perspectives, to look critically at their own practice and those of their colleagues, and to focus on particular elements of their teaching they want to improve”. Cameron et al. (2013) also found collaboration, in the form of observing other teachers’ practices and sharing ideas, valuable to improve teaching practice.

As highlighted above, collaboration arguably is an efficient means to improving teaching practice and student outcomes. Thus, many recent studies have researched the notion and effectiveness of collaboration in relation to TPL contexts. This study aims to explore the possibilities of collaboration through social media.

2.2.3 Teacher collaboration in professional learning communities

Studies indicate collaboration is a key characteristic of TPL communities (Admiraal et al., 2016; Darling-Hammond & McLaughlin, 2011; Mansfield & Thompson, 2017). Teacher communities are described as settings or conditions for sustainable collaboration (Admiraal et al., 2016). Support through a learning community enables teachers to discuss the challenges of teaching, develop strategies to overcome them, and apply their professional learning to their teaching practice.

Different approaches exist in the literature regarding TPL communities. As stated in section 2.2.1, a great deal of previous research into TPL communities has focused on school-based communities. Beyond school level, the literature also highlights the effectiveness of TPL communities on a wider scale. Darling-Hammond and McLaughlin (2011) explained different forms and aspects of TPL communities. While they emphasized the benefits of school-based communities for teachers to provide help and support for each other as friends and colleagues, their study also explained the power of TPL communities beyond schools. Collaboration in wider communities based on subject or pedagogy could support teachers to overcome teaching challenges. Having an open community that extends beyond a school could improve sources of learning and ideas (Stoll, Bolam, McMahon, Wallace, & Thomas, 2006). For example, teachers may learn and develop their teaching practice through collaborative partnerships with universities by learning pedagogical theories or through participating in action research processes.

While collaboration is a key to successful professional learning, time and place (distance) can limit face to face peer collaboration (Carr & Chambers, 2006; Deluca et al., 2014; Timperley et al., 2007). In this regard, Opfer and Pedder (2011) devoted some attention to limitations of time and space for regular meetings, observing other teachers' practice, discussion and review. Mansfield and Thompson (2017) also identified some challenges involved in the process of collaborative learning, including time and logistics. To overcome these challenges, online communities can help. Synchronous and asynchronous learning, which occur in online communities using social media, could provide learning for teachers with fewer limitations (Trust, 2012).

After reviewing the literature, Stoll et al. (2006) identified eight characteristics which make a professional learning community effective: "shared values and vision; collective responsibility; collaboration, promoted group and individual learning, and reflective professional inquiry" (pp. 226-227). They also identified "mutual trust, respect and support among staff members; openness, networks and partnerships" as characteristics to improve a community's quality and make a community effective. These characteristics can be identified in Communities of Learning in New Zealand Schools (Kāhui Ako). Communities of Learning in New Zealand Schools is an initiative supported by the Ministry of Education, which aims to bring together schools, teachers, and communities with shared goals. With a collaborative approach, teachers are able to identify common challenges regarding student learning. Collaboration through Kāhui Ako enables teachers to share their expertise in teaching and learning, and support each other, which in turn could bring positive change in their teaching practice that impacts students' learning, achievement, and success. As part of this initiative, a Virtual Learning Network (VLN) was established in order to provide online resources and support for teachers and schools (Ministry of Education, 2019a).

Considering the effectiveness of TPL as part of a wide community, much of the current literature on TPL pays particular attention to online communities (Carr & Chambers, 2006; Davis, 2015; Deluca et al., 2014; Hou, 2015). Online communities are not limited to a single school, and teachers have opportunities to collaborate with other teachers and experts outside their schools. Teacher engagement in online communities can provide them with "meaningful" professional learning (Deluca et al., 2014, p. 338). Online communities can enable teachers to learn through interaction and communication. They

can afford teachers access to knowledge and resources beyond their geographical location. Such learning fits with ideas of 21st century learning, as discussed next.

2.2.4 Teacher professional learning for 21st century education

Literature on learning for the 21st century is based on the idea that learning involves collaboration, using technology, promoting and enhancing critical and creative thinking, and ability for problem solving (Chai & Kong, 2017; Howland, 2012). Education in the 21st century emphasizes the importance of integrating online and digital technology in learning. Using online environments accords with learners' need to become fluent in the use of digital technology (New Zealand Government, 2016). Digital fluency comprises learning new attitudes, knowledge, and skills to address the educational needs for the 21st century (White, 2013).

As noted in section 2.2.1, teachers have to learn to adjust their teaching practice in relation to students' learning needs (De Neve, Devos, & Tuytens, 2015). The characteristics and educational needs of the 21st century require new methods for learning (Gardner, 2006). This applies also to TPL as a foundation for students' learning. Teacher professional learning through communities on social media is aligned with 21st century education. For example, in order to learn through social media, teachers need to make decisions and acquire skill in discerning useful information and resources. Learning through social media is also a collaborative endeavour using technology and can enable teachers to be exposed to new ideas and practices (Davis, 2015).

To achieve 21st century learning goals, teachers are expected to prepare students to live and work successfully in a contemporary, connected world. In order to guide students through the process of learning and utilizing technology, it has been argued that teachers should improve their abilities in using online and digital resources (Killion, 2011). In this regard, the New Zealand education system promotes teachers' engagement in learning, using digital technology and online platforms supported by 21st century learning frameworks (Ministry of Education, 2016d). With regard to the integration of digital technology in education, the New Zealand education system has announced approaches that highlight a vision for using digital technology in line with 21st century educational goals (New Zealand Government, 2016). This has implications for teaching in all subject areas, including EE. A review of TPL related to EE is presented next.

2.2.5 *Teacher professional learning in environmental education*

Since 1970, teaching about environmental concerns has been suggested for inclusion in school curriculums, leading to teacher education and qualifications in EE being recognized as needed for teaching this topic (Rakow, 1985). Such EE was seen to be within the capabilities of teachers, who could become knowledgeable about well-understood environmental issues and teach about them. However, the impact of EE through this knowledge delivery approach was soon recognised as only partially effective (Eames, Bolstad, & Cowie, 2004). New approaches in EE emphasized student learning *in* the environment and *for* the environment in order to engage them fully in environmental issues and have them *make decisions and take action* towards resolving environmental problems (Warner, Eames, & Irving, 2014). This approach requires many teachers to adopt different teaching strategies. For example, in some education systems, traditional classrooms have shifted to new or alternative educational environments linked to nature. Teachers' learning is an important priority within education (UNESCO, 2002), and TPL in EE is then essential in educating teachers to participate in the natural environment, teach for the environment and undertake action-taking approaches in EE.

Furthermore, teachers' own enhanced environmental knowledge has been shown to increase their confidence to teach EE (Shin, 2008). In shifting from traditional classroom teaching to the educational imperatives of 21st century learning, teachers' own enhanced knowledge would help them adapt to this new learning environment. Environmental issues are dynamic due to natural, technological and social causes (Sustainable Aotearoa New Zealand, 2009), and as such knowledge rapidly changes. As the world faces a range of ecosystem degradation issues, TPL can play an important role in equipping teachers with new knowledge for EE. This could help teachers develop knowledge and therefore confidence to *take action* toward the environment and teach *for* and *through* the environment (Birdsall, 2010). In this regard, it has been suggested that TPL be a key priority to improve and promote EE (UNESCO, 2002). To achieve sustainability, teacher education is considered as one of the key targets in the UNESCO education strategy (UNESCO, 2014).

The New Zealand EE *Guidelines* indicate that interdisciplinary, holistic teaching and learning approaches are appropriate for meeting the aims of EE (Ministry of Education, 1999). Environmental education therefore is not a standalone subject; rather it is argued

that it should be integrated into content curriculum areas. The literature, however, suggests that teachers face some challenges integrating EE into school curricula, due to lack of support and professional learning. A review of the EE literature has indicated a noteworthy lack of TPL programmes in EE since the 1980's (Bolstad et al., 2015; Chalmers, 2011; Wilke, Peyton, & Hungerford, 1987).

The New Zealand government has considered the role of education in the national strategic plan for sustainable development as an investment in the future (Frame & Marguardt, 2006). In response to the production of the *Guidelines* (Ministry of Education, 1999), a national professional development and learning programme for EE was established in 2000 by the Ministry of Education (Eames et al., 2004). This programme focused on EE delivery using the *Guidelines* that had been sent to every school, but not all schools or teachers were able to participate (Law, 2004). This programme ran from 2000-2009, after which time the government removed funding. Since 2009, teacher professional learning opportunities have been limited to private study and partnerships with NGOs, most notably the Enviroschools Programme (C. Eames, personal communication, June 2, 2016). While a professional learning approach can encourage teachers to use innovative ways to address EE within their current school programmes, this research suggests that, given the current lack of formal TPL available in EE, collaborative learning opportunities through social media might be an appropriate aid to develop teachers professionally in EE. This topic is examined next.

2.2.6 Section summary

Effective teaching is concerned with student learning and achievement. Student learning is a consequence of both teachers' knowledge and teaching practice. Teachers need to be lifelong learners, so continuous high-quality learning and practical development are integral to their profession. The importance of TPL is that it offers teachers new knowledge and skills in order to enhance their teaching practice to improve student outcomes.

Literature characterizes effective TPL methods as collaborative, ongoing, and integrated into teachers' practice. These are linked to informal TPL, which is unbounded and can take place any time in the teachers' career. As informal TPL is linked to teaching practice, it can more positively affect students' learning outcomes. Informal TPL characteristics

are linked with Teaching as Inquiry in the NZC. Teaching as Inquiry is a process which involves analysing student achievement to identify their learning needs, find suitable teaching strategies, and apply those methods in their practice.

Teacher professional learning through a learning community is effective, as it is collaborative and ongoing. Teachers receive support from other teachers or experts by engaging in a learning community. As online communities are unbounded, teachers have further opportunities for collaboration. Through wider connections, they receive more support and resources with less limitations in terms of time and place. Collaborative TPL community is also in line with 21st-century learning goals towards utilizing technology in teaching and learning.

In the EE context, TPL is important in order to prepare teachers with new knowledge to integrate EE in school curricula and improve student learning. Environmental education aims to raise responsible citizens who are knowledgeable and skilful, and are able to effectively participate in or influence decision-making about the environment. Teachers therefore require updated and effective pedagogical content knowledge to improve students' knowledge, attitudes, and skills toward sustainability. Digital technology affords opportunities for collaborative and continuous TPL and could enable EE teachers to obtain the pedagogical content knowledge needed to raise students' knowledge and skills to the levels required to respond to global environmental challenges and work towards sustainability. One type of digital technology that could play a part is social media and this is examined next.

2.3 Social media and social learning

Social learning theories provide explanations of the learning process, which are helpful in analysing the relationship between social media and TPL in this study. As each theory investigates a specific perspective in the process of learning, more than one theory might be used to achieve the research objectives. This section begins with a discussion of social media and then provides an overview of the literature related to relevant theories of learning, with an emphasis on social learning.

2.3.1 *What is social media?*

Bryer and Zavattaro (2011) characterised social media as “technologies that facilitate social interaction, make possible collaboration, and enable deliberation” (p. 327). Osborne-Gowey (2014) defines social media as “a collection of websites and applications designed to build and enhance online communities for networking and sharing information” (p. 55). Kapoor et al. (2018) emphasised the social characteristic of social media as communication websites. Through social media, individuals are able to create a public or semi-public profile, build and articulate a network of people and information, join other networks, view other individuals’ connections and activities, leave comments, express their ideas and gain and share information (Boyd & Ellison, 2007). Social media is user-created, user-controlled, and flexible (Kapoor et al., 2018). Social media offers a special environment for social interaction (Gonzales & Young, 2015) and scholars are united on the key notion of what makes it social: concepts of interaction, communication, and collaboration (Fuchs, 2017).

Unlike traditional mass media, such as newspapers and television, social media allows individuals to use the media actively by posting new information and adding comments, a process which “encourages inquiry and decision-making” among users (Kapoor et al., 2018, p. 531). Social media users are able to create relationships with others beyond their geographical and social backgrounds. These connections result in generating extensive amounts of both reliable and unreliable information (Kapoor et al., 2018). Another key difference with traditional media is that social media, being web-based, is always extensive with “no predetermined limits on pages and time” (Akoumianakis, 2009, p. 3). Social media covers blogs, wikis, media such as audio, photo, video, text, and sharing tools, networking platforms, and virtual worlds (Bryer & Zavattaro, 2011).

Despite the common characteristics of social media, “based on the richness of the medium and the degree of social presence it allows”, various types of platforms are distinguished by Kaplan and Haenlein (2010, p. 61). The *collaborative project* is text-based user-generated content, such as Wikipedia. Other text-based social media, such as *blogs*, are created and managed by one person, but there is the possibility for others to contribute by commenting on posts. In a *content community*, members are able to share various media content including text (e.g. Book Crossing), photos (e.g. Flickr), video (e.g. YouTube), and PowerPoint (e.g. SlideShare). *Social networking sites*, such as Facebook, enable the

sharing of any type of media. The *Virtual game world* and *virtual social world* create a virtual reality based on real life (Kaplan & Haenlein, 2010). In this classification system, text-based platforms, such as Wikipedia and blogs, score lowest in terms of social presence, while in comparison social networking websites, such as Facebook, have the higher scores. The ability to post different types of content, such as video clips and photos, on Facebook and YouTube distinguishes them from text-based media. Another classification system for social media is presented by Dabbagh and Reo (2011) and is based upon different affordances of social media platforms. This classification includes experience and resource sharing tools, such as blogging, microblogging and bookmarking (e.g. Twitter); collaborative workspaces (e.g. wikis); media sharing tools (e.g. YouTube); social networking sites (e.g. Facebook); and web-based office tools (e.g. Google Apps).

2.3.2 Social media in this research

Social media offer global connections, which enables access to a wide range of knowledge and perspectives. There are hundreds of social media platforms, connected websites, and applications to wade through as a research landscape. However, in the context of TPL in this study, my focus is on the use of social media to facilitate interaction and wider collaboration between EE teachers, environmental experts, and information resources in New Zealand. The study therefore was not limited to using a specific social media platform, so that any platforms that are commonly used by EE teachers could be considered.

The intention of this study was to ascertain teachers' concepts and definitions of social media, and their favourite platforms for learning, as there is little evidence available about EE teachers' social media use in their professional learning. In addition, the study might have been too limited if it had been restricted to a specific platform, since teachers have different social media preferences. In addition, social media is dynamic and fast moving. The most popular platform today may disappear in the future. Also, the study investigated how teachers perceive their professional learning in EE through social media. It included finding teachers' agreed or preferred platform(s) which they are willing to use or are already using in their professional learning. This also helped the researcher to avoid bias in choosing a research domain.

Although social media is a broad concept with a wide range of platforms, this research considered the openness of the media and the potential for wider connections and popularity among New Zealand teachers. It also considered the capability of a network to be open to new participants entering almost seamlessly. On the one hand, one-to-one conversation between known colleagues, for example through Skype, would enable interaction, communication and collaboration. However, in the context of this research, it was not considered because it is too closed and limited to known individuals in small numbers, without the possibility for others who may not be directly known to easily join in and connect, based on mutual interest.

Social media here refers to those platforms which enable synchronous and asynchronous communication and interaction between teachers in different places. This type of communication is supported and provided by more open social media platforms, such as Facebook, Twitter, YouTube, and Instagram. Thus, the communication tools or mobile applications, such as WhatsApp, which require the other person's contact number, or Google hangouts which rests upon a pre-arranged conversation with invited people who have met via another forum are not considered as social media in this study.

Building upon previous studies this research assumes that some social media platforms are more popular than others amongst teachers in general, because of the opportunities they provide for interaction and collaboration. Such platforms include, but are not limited to, Facebook, Twitter, Pinterest, Google+, Instagram and YouTube (Kapoor et al., 2018). This study therefore investigated whether such social media platforms are also popular with EE teachers in New Zealand as a means of professional learning.

2.3.3 Social media for learning

Dron and Anderson (2014) have explained the way different social media platforms support learning in different social forms, *groups*, *networks* and *sets*. Groups, such as classes, tutorial groups or schools, are structured with pre-defined learning objectives and specific roles, as well as rules for joining. A group requires commitment for design, management and maintenance. Shaping and maintaining a group can therefore be expensive. As Dron and Anderson (2014) note, "learning management systems, content management systems and groupware tools" are online tools to support groups (p. 3).

Unlike groups, networks, such as friends or colleagues, generally do not have specific rules, a defined purpose, or formal name. Networks facilitate just-in-time learning and allow individuals to benefit from diverse knowledge with limited boundaries. However, as there is no structure or guidance, learning through networks needs commitment, considerable effort, and decision making from individuals. “Email, social networking sites, blogs and instant messaging” are common tools to support learning through networks (Dron & Anderson, 2014, p. 3).

Similar to networks, sets do not generally have specific rules or structure. Sets consist of people who do not know each other but share common interests, skills or locations. Although sets are useful when there is no access to a group or a network to find information or knowledge, they too demand effort and decision-making. Learners need to decide what to learn and to make decisions about the reliability and relevance of information and resources shared on social media. “Social interest sites, curation sites, location-oriented tools, Q&A (questions and answers) sites, and public wikis like Wikipedia are common tools to support sets” (Dron & Anderson, 2014, p. 3).

Social media have currency with social learning as an effective environment for informal learning through collaboration and discussion (Dron & Anderson, 2014). Learning in this study takes place wherever teachers have the need, motivation, and opportunity for learning. This kind of learning is informal and self-directed, with active participants, and includes networking, coaching and mentoring (Marsick & Watkins, 2001). Social media have influenced all aspects of our daily life (Hart, 2011), as they contain a variety of information and resources (Visser, Evering, & Barrett, 2014). Therefore, individuals acquire information, knowledge and even skills through social media by informal learning (Chen & Bryer, 2012). Social media provide an opportunity for users to interact with other users and is characterised by active participants. Active learning motivates learners to engage in learning more and spend more time on the process of learning (Bandura, 1986).

Collaboration has been identified as a major factor in learning through social media (Gonzales & Young, 2015; Hao & Lee, 2015; Holmes, Preston, Shaw, & Buchanan, 2013; Mondahl & Razmerita, 2014; Ravenscroft, Warburton, Hatzipanagos, & Conole, 2012; Rutherford, 2013). Through social media, learners are able to contribute and collaborate

despite their locations (Hao & Lee, 2015; Vivian, Falkner, & Falkner, 2014) and with fewer limitations (Trust, 2012).

In this study, the social learning approach using social media is also aligned with the ideas of peer social support (Greenhow et al., 2018) as one of the key aspects of TPL in EE. With reference to the study of social relationships and health by House, Landis, and Umberson (1988), peer support in this study includes instrumental support, informational support and emotional support through social media. In this study, instrumental support involves direct assistance from peers to provide learning aid and/or learning materials; and informational support refers to indirect help through guidance toward the right direction and information. Social media can enable teachers to talk with other peers, experts, and community members with no limitation of time and place, enhancing emotional support (DiPaola, 2012).

There is a clear relationship between social learning and learning theories linked to social media (Merchant, 2012). In order to find this relationship, the next section explores how social media can afford learning opportunities based on socially focussed learning theories.

2.3.4 Theories for teacher professional learning

The possibilities and methods of learning in general (Dron & Anderson, 2014) and TPL in particular (Gerdeman, Garrett, & Monahan, 2018) have expanded, due to the use of technology. Learning through social media is connected to the notion of social interaction and collaboration (Dron & Anderson, 2014). Social learning is collaborative, active and learner-centred (Mondahl & Razmerita, 2014). Social media potentially improves active learning in a learner-centred collaborative environment (Hajli, Bugshan, Lin, & Featherman, 2013). Social learning theories can therefore help explain the process of learning through social media.

Social learning theories share similarities and differences. Their differences, *however, are not important* for the purposes of this study. While each theory emphasises a different aspect of social learning, the social aspect of all these theories brings them together. To help understand this point, the characteristics of four social learning theories that appear relevant to this study; social learning, social constructivism, situated learning and connectivism, are summarised in Table 2.1. This table shows the relevance of various

social learning theories in the context of social media use for learning. Then, this section discusses how these social learning theories may be linked to TPL through social media.

Table 2.1
Characteristics of social learning theories

	Social Learning Theory	Social Constructivism	Situated learning	Connectivism
Learning occurs through	Observation and modelling in a social context	Interaction with social groups	Real contexts and situations	Connecting individuals, information and digital formats
Learning is	Collaborative	Collaborative	Collaborative	Collaborative
Learning approach is	Learner-centred	Learner-centred	Learner-centred	Learner-centred
Learning process is	Active	Active	Active	Active

2.3.4.1 *Social Learning Theory*

Albert Bandura is considered as one of the leading theorists in establishing the concept of social learning. *Bandura's Social Learning Theory (SLT)* suggests that people learn from *one* another in social contexts (Bandura, 1977). SLT emphasises the importance of observation and modelling in the learning process by claiming that individual or learner behaviour is influenced by observing other people's behaviour in different situations (Bandura, 1977). Bandura also noted the influential role of mass media in society (Bandura, 2001). In recent years SLT has become linked with the use of social media in TPL (Watson, 2013).

Social learning theory emphasises learning through observation and modelling in a social context which is characterised as collaborative, learner-centred and active. In consideration of the ways people learn from others, it is possible that teachers who are involved in EE may learn from other teachers. Social media could help to link teachers and provide them with collaborative learning opportunities in EE. As SLT suggests, effective learning is the result of observing other people practise and interaction with other learners (Bandura, 2001). In this research, SLT could involve teachers observing each other's practice, lesson plans, term plans and teaching materials through social media.

2.3.4.2 *Social Constructivism*

Vygotsky (1978) viewed learning as an active social process which occurs in social groups. This perception of learning established the field of social constructivism. His theory is based on social interaction and collaboration as the foundation for development, represented by learning as a process that takes place in social groups. Individuals thus make meaning and create knowledge through experiences, collaboration and incorporation with people in different situations. Learning in this view is a process of understanding and constructing knowledge, which is a social activity rather than individual action. Learning in a constructivist view is considered to be the subjective process of creating meaning from experiences (Ertmer & Newby, 2013).

Vygotsky (1978) regarded collaboration as a key concept in learning, whether between learners and learners, learners and tools, or learners and instructors. Vygotsky's Zone of Proximal Development (ZPD) describes the area between the level of achievement possible for learners working independently, and the level of achievement for learners with assistance and collaboration. For Vygotsky, the ZPD is the differential in learning possibilities with and without help from a capable peer or teacher. Within the ZPD, he assumed that an individual's skills and understandings could be developed by collaboration and engagement with knowledgeable people or environments. Vygotsky's theory asserts the role of guidance from a more experienced person, structure, tools or teacher as *mediating agents* in learning (Ng, 2015).

Learners therefore are active in constructing their knowledge in a learner-centred environment rather than simply acquiring knowledge. Active learning in this theory is far more than mental activities and requires interaction with other learners or teachers. Following Vygotsky, this research assumes that communication, collaboration, and discussion with more experienced teachers or experts will assist EE teachers in building required knowledge and teaching practice in EE. As face-to-face communication and direct collaboration between teachers is limited by time and place, social media could be used for collaborative learning (Popescu, 2014). Through social media, learning emerges under social constructivist theory as an intertwining of connections between teachers, experts, and community members, as well as information available on the internet. Through social media, these *mediating agents* are able to provide scaffolding and support for EE teachers to move within ZPD.

In relation to ZPD, this research focuses on the collaborative interplay between the use of social media and EE professional learning for teachers. The social process of learning in ZPD is closely linked to learning through a learning community. Therefore, situated learning theory is also influenced by social constructivism (Lave & Wenger, 1991).

2.3.4.3 *Situated learning theory*

In situated learning theory, Lave and Wenger (1991) argue that learning takes place in a situation which involves a connection between individuals and their knowledge through social interaction. Social connection for interaction and collaboration is an essential characteristic for learning in situated learning theory. Situated learning is carried out through the community of learning. A community of learning is a group of people with a shared concern or interest, who are involved in the process of learning in a particular profession or practice (Lave & Wenger, 1991). Acquiring knowledge or changing attitudes and behaviour takes place within a community of learning. As this term (community of learning) has other meanings in New Zealand education (see section 2.2.3), from this point onwards I will use the term “learning community” (LC) to distinguish it from Communities of Learning (CoL) in New Zealand.

A learning community can be established by people who have the same goal and/or are involved in a learning process in a common field. As discussed in section 2.2.3, collaboration is a key in a learning community. Community members learn from each other, cooperate in some activities to gain or develop their experience and knowledge, share information, engage in discussion, and help each other, based on their community connection (Lave & Wenger, 1991).

The idea of a LC fits well with the online environment, where members do not have to be in the same place or engage at the same time. Therefore, a virtual learning community (vLC) can be formed: a vLC “is a network of individuals who share a domain of interest about which they communicate online” (Gannon-Leary & Fontainha, 2007, p. 2). Discussion, collaboration, peer support and sharing information are key features of a vLC (Ostaszewski & Reid, 2010). Communication and discussion help learners to clarify unclear issues (Lave & Wenger, 1991). Communication tools on social media provide a means for teachers’ professional communication, discussion, and debate. Thus, there is

potential to establish and develop vLCs through social media as an online environment (Gannon-Leary & Fontainha, 2007).

This research aims to explore the possibility and effectiveness of a teachers' learning community through social media in EE. A learning community through social media could help peer to peer and teacher to expert discussion, which may enable teachers to become more knowledgeable in EE in order to help their students through the process of learning. Arguably, social media might then be an appropriate tool to be used in TPL if a learning community could be established that enables teachers to come together to provide learning support for each other. A learning community is identified by its specific characteristics, the domain, the community members, and the practice. The domain or the common area of concern separates a member of a community from others. Teachers here are concerned about EE learning and teaching (the domain). Teachers in a community learn from each other, cooperate in some activities, share information, engage in discussion, and help each other, based on their community connection (the community). As a member of a community, EE teachers should participate, interact and learn together, gain or develop their knowledge and skills (the practice). In the context of TPL in this research, the theory of situated learning is useful, where teachers' understandings of EE and their teaching methods are developed through collaboration and discussion as well as with help from experienced teachers or experts in this field.

With regard to the concept of a vLC, this research is concerned with the profound bond between networked technology and vLCs. The role of social media here is providing platforms which afford connections and communication with limited boundaries in terms of place and time for teachers' collaboration. Social media afford opportunities for teachers to participate in a vLC. Connection between members in a vLC affords collaboration and peer support in terms of information, communication, discussion and resources.

This aspect of learning through communities influenced Siemens (2005) and Downes (2005) to establish and elaborate the theory of connectivism.

2.3.4.4 *Connectivism*

In connectivism, learning and knowledge are distributed through the network, rather than held by a single person. Connectivism therefore views learning outside of individuals, as

a process which occurs through connecting particular types of information through a digital network (Siemens, 2005). Considering this assumption concerning connectivism, it offers a learning model which can incorporate existing digital tools, environments and networks (Goldie, 2016).

Connectivism is concerned with determining the effects of digital technology on modes of connection, communication and learning through networked communities (Ng, 2015). With Web 2.0 technology, learners are not only consumers but also producers of information. This provides opportunities for all to disseminate and share their ideas, information and knowledge and/or gain knowledge and information. It changes the traditional learning method, which exists as one-way communication from teacher to learner, to learning networks where there is distributed knowledge beyond individual minds (Foroughi, 2015; Yang & Yuen, 2010).

As Siemens (2005, p. 5) explains, “learning and knowledge rest in a diversity of opinions and is a process of connecting specialised nodes or information sources”. Siemens has described the main principles of connectivism based on his claim. Learning to him is a process of connecting learners and information. These information resources can exist not only in humans but also in non-human appliances. For learners, it is important to choose the knowledge they want to learn amongst all available materials and resources. In order to learn, learners also need to maintain and develop their connections continuously. Accordingly, the role of informal learning through connection with others is important in connectivism. As Siemens (2005) explained, the growth of knowledge and technology in the contemporary world requires continual lifelong learning outside of formal schooling. Formal education only applies to a part of the learning process alongside daily learning opportunities through interactions with networks of friends and colleagues outside of set places and times (Bell, 2011). Therefore the role of informal learning through connection with others is undeniable (Siemens, 2005). Connectivism reflects learning that occurs in a networked society. In contrast to earlier theories, an instructor or an individual learner is no longer the sole person in the learning process. The focus thus is on the information, ideas, and interaction within a learning network.

“Knowledge is a network phenomenon” (Yang & Yuen, 2010, p. 16), which is distributed through networks of individuals, information systems and digital formats (Downes, 2007; Ng, 2015). Learning therefore is a process of connection and increasing involvement and

interaction through networks (Downes, 2007). Networks are formed by connections between nodes (entities). A common interest in specific information shapes diverse networks through connections between nodes. A node is not only an individual, but it can be a field, or an idea as well (Bell, 2011). Networks also vary with the diversity of members in terms of numbers, size and strength (Ng, 2015). The process of learning occurs when learners' knowledge is activated through the processes of contribution; connecting to a network and sharing, gaining and distributing thoughts and information; and cooperating with other learners (Downes, 2007; Kop & Hill, 2008). In this way, learning occurs within and across various environments, a process described by Siemens (2005, p. 2), who writes that "know-how and know-what is being supplemented with know-where". Knowledge exists with disseminated resources whereby individuals have to decide which sources to use, distinguish between items of information and select the most valuable resources (Siemens, 2005).

Connectivism has emerged as a learning theory related to the digital and communication era, which has currency with learning through social media (Siemens, 2005). It has the potential to provide a theoretical framework for TPL in EE in terms of social media perspectives. When knowledge is no longer centralised but distributed, teachers are able to learn collaboratively through discussions, conversations and communications. This kind of learning occurs continuously, adjusting to teachers' learning needs and interests. In the context of this research, teachers' interactions, through a vLC, scaffolding within ZPD, an interconnected learning community of EE teachers and experts could be described by connectivism. Thus, although learning through social media can be supported by all the learning theories discussed above, the study focus is primarily on connectivism.

2.3.4.5 Connectivism as a theoretical framework for this study

While social learning theories may provide a basis and explanations for learning through social media, the inherent characteristics of social media use could contradict some elements of these theories in this study. For instance, in Social Learning Theory the mutual relationship between learners and their environment is highlighted as a key component because learning occurs by observing the behaviour of others (Bandura, 1977). However, opportunities for teachers to engage with peers in a collaborative environment

and observe other teachers' practice as well as student activities are problematic (Koranteng, Wiafe, & Kuada, 2018).

Social constructivism relies upon people forming close ties in groups (Vygotsky, 1978). However, the ties made via social media can be weaker and more tenuous than what is required for learning (Dawson, 2008). Also, social constructivism relies upon timely, constructive feedback from knowledgeable senior peers (Vygotsky, 1978). Social media, on the other hand, create asynchronous delays (Davis, 2015). In addition, it is difficult to verify the authority of sources on social media (Al-Samarraie & Saeed, 2018). Situated learning implies that the learning takes place within the environment, in situ, is hands on and practical (Lave & Wenger, 1991), whereas social media are online and somewhat removed from the real world, actual environment and face to-face interaction (Koranteng et al., 2018).

With these assumptions, the use of social media presents difficulties in the application of SLT, social constructivism and situated learning theories. Connectivism, however, was built on social learning theories for e-learning environments regarding the learning environment as one where knowledge is distributed between learners. The application of connectivism as a theoretical framework could overcome the negative affordances of social media, as the connectivist framework was proposed to explain the way in which learning occurs in an online environment (Downes, 2005; Siemens, 2005). Connectivism, therefore, can be used as a theoretical framework in this study, due to its ability to provide a lens through which learning using social media can be better understood and managed.

Collaboration is the main aspect highlighted in social learning theories in this study. Collaboration, however, requires connection between teachers, teachers and information, and teachers and EE experts. Connectivism can bring the learning theories in this study together and offers a model for applying other learning theories in this study by using social media. In the context of this study and with regard to the theory of connectivism, social media enable a dynamic, multi-directional connection among and between EE teachers, experts, and information all around New Zealand. Teachers' networking through social media could provide a unique opportunity for informal collaborative learning in EE.

As shown in the theoretical framework of the study (Figure 2.1), observation and learning from others (SLT), scaffolding in learning (from ZPD in social constructivism), and group collaboration through LC (from situated learning theory) are possible through a consideration of connectivism. This framework explains that teachers who are engaged in EE would learn through connection with other teachers, experts, and information sources using social media.

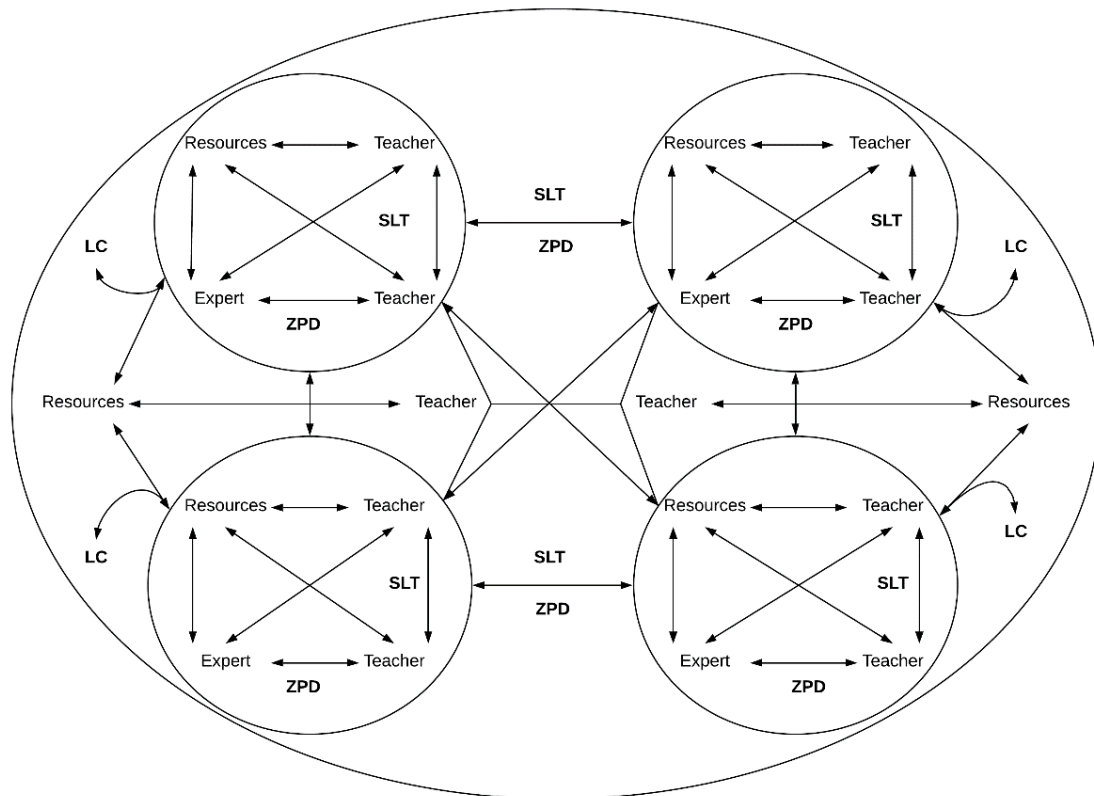


Figure 2.1 The research's theoretical framework based on connectivism

2.3.5 Teacher professional learning through social media

As discussed in section 2.3.4, learning is often constructed through social interactions. Consequently, teacher collaborative learning is recognized as more effective than learning in isolation (Mansfield & Thompson, 2017). The main factors in using social media for TPL are related to the collaborative nature of social media, which provide collaboration and network opportunities for teachers (Greenhow et al., 2018; Holmes et al., 2013). Social media have the potential to be used for educational purposes, and educators consider them an informal learning environment (Visser et al., 2014).

Teacher professional learning through social media is informal collaboration with peers or professionals. It is easily accessible and can help teachers improve their knowledge and transform their teaching practice to improve student learning (Beach, 2012). Teachers are able to communicate with each other through social media in sharing teaching experiences, practices, quandaries and ideas (Sjoer & Meirink, 2015) as social media “enable collaboration, collective knowledge building and exchange of ideas” (McLoughlin, 2011, p. 849). Such usages of social media for professional learning may add to the development of new ideas through teacher involvement and collaborative learning (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). Learning through social media is not limited to a certain area or a group. It enables collaborating and networking opportunities with colleagues locally and globally (Ross et al., 2015).

Social media afford both synchronous and asynchronous learning for teachers (McConnell, Parker, Eberhardt, Koehler, & Lundeberg, 2012). Also, through social media teachers may be willing to participate in professional learning because, in opposition to formal learning, fewer limitations are put on time and place (Anderson, 2006). By utilizing social media, teachers are “engaging in ongoing professional development through anytime-anywhere learning opportunities and are participating frequently in asynchronous and synchronous learning opportunities” (Ross et al., 2015, p. 73). As noted in section 2.2.1, effective TPL requires ongoing learning (Timperley et al., 2007). Social media empower teachers with ongoing learning as teachers’ online collaboration is generally conducted over a longer period of time. Therefore, teachers have more time to reflect on how their learning relates to their teaching practices (Ostashewski et al., 2011; Sari, 2012; Trust et al., 2016).

Ross et al. (2015, p. 55) defined TPL through social media as “highly engaging, dynamic, and interactive applications that allow for individualized learning through the management and selection of content, co-construction of knowledge, demonstration of competencies, and generation of networks for ongoing learning”. Social media has the potential to be used in order to “transform the paradigm of the isolated teacher into that of a lifelong, connected learner” (Ross et al., 2015, p. 58). Learning through social media as ongoing learning is in line with 21st century learning goals (McLoughlin, 2011).

In a review of the literature on social media in TPL, the authors (Greenhow et al., 2018) identified some advantages of TPL through social media. Their review shows that

teachers' experience of social media is associated with "teachers' emotional needs, including general encouragement, self-esteem building, meaningful connections to combat isolation, and identity work" (Greenhow et al., 2018, p. 2260). Teachers also benefit from being independent learners. Through social media, teachers have opportunities to personalize, frame and control their learning. Learning through social media is self-directed and flexible, and teachers can choose topics and times for learning. Building on the work of Greenhalgh and Koehler (2017), Greenhow et al. (2018) described learning through social media as "just-in-time" learning. Using Twitter for research, Greenhalgh and Koehler (2017) argued that social media have the potential to provide focused and timely support for teachers in specific circumstances.

Much of the research on TPL through social media has focused on identifying its advantages. Some scholars, on the other hand, have highlighted several challenges regarding learning through social media. The identified challenges, however, are mostly associated with the use of a particular social media platform, such as Facebook or Twitter, or specific challenges regarding learning in a specific context. In the context of the professional use of social media, Carpenter and Harvey (2019) have presented a number of challenges inherent in using social media for teaching and learning.

They identified tensions associated with using the same social media platform for both personal and professional purposes. Teachers in their study found learning through social media overwhelming and time-consuming because they try to catch up with everything. For example, the personal use of Facebook interferes with its professional use as they receive a number of posts which they need to follow and read (Carpenter & Harvey, 2019). Managing the professional use of social media is challenging, as teachers need to balance and build boundaries between their personal and professional use of social media (Carpenter & Harvey, 2019; Carpenter, Kimmons, Short, Clements, & Staples, 2019)

Their findings also suggest that learning through social media can expose teachers to interaction with colleagues from other schools whose expertise, credibility, and accuracy are doubtful. Teachers were concerned about receiving disapproving comments from other community members. This can limit teachers' activities on social media. Some teachers therefore mitigated this possibility by using other communication methods, platforms or tools, such as closed Facebook chats or messaging and phone calls, that offer more privacy. As perceived by teachers in Carpenter and Harvey's (2019) study, there is

the potential to be distracted by other information as well as political discussions on social media. The teachers also found that teachers' political views affect discussion on social media, which can result in ineffective exchanges.

Drawing on the literature, Greenhow et al. (2018) identified some barriers to learning through social media. Inconsistency between teachers' interest and their willingness to use social media for professional learning and a lack of technical skills were highlighted in their study. As mentioned previously, time was also noted as a barrier regarding TPL through social media. Learning through social media can take up teachers' personal time. In the qualitative studies in two Australian high schools which explored the ways in which digital technologies are implicated in the school teachers' work, Selwyn, Nemorin, and Johnson (2017) found that teachers have to spend their personal time for work as they feel they have to engage with professional learning in evenings and weekends.

In a study on teachers' perceptions of Twitter for professional learning, Davis (2015) found that *time* spent on professional engagement through social media was described as interrupting teachers' personal time. This is because teachers often use social media after regular school hours, as they are not allowed or supported to use social media during school hours. In addition, teachers' limited time for learning due to their busy schedules could limit their engagement with social media for learning.

Davis's study also shows that teachers feel 'overwhelmed' by the constant flow of information shared on social media (Davis, 2015, p. 1556). Some teachers saw learning through social media as a time waster, superficial and tedious and presenting untrustworthy information. Recourse to social media is also banned or limited in some schools, which makes using them for learning difficult. Davis (2015, p. 1556) labelled social media barriers as "technological drawbacks including managing the flow of information, misperceptions of Twitter for professional development, time, misunderstandings, limits to participation, reduced access, and not feeling heard". In a study on mathematical resources available on Pinterest, issues with the quality and accuracy of content shared on social media were identified (Hertel & Wessman-Enzinger, 2017)

Studies on the use of social media as teaching and learning tools in education have also addressed some challenges in using social media for learning. In a study on the value and

use of social media as effective teaching and learning tools in higher education in developing countries, the authors identified privacy and time as important barriers to using social media (Sobaih, Moustafa, Ghandforoush, & Khan, 2016). Also, learners' focus on learning can be easily distracted due to other aspects of social media (Lampe, Wohn, Vitak, Ellison, & Wash, 2011). A study by Kurtz (2014) on students' perceptions of using a Facebook group revealed the need of effective pedagogical principles for active and collaborative teaching and learning. In a review of the literature on cloud computing tools, including social media, for collaborative learning, Al-Samarraie and Saeed (2018) identified lack of trust as a reason which might reduce learners' participation and intention to share knowledge in a collaborative activity.

In summary, social media affordances for learning have become a major focus in TPL. In terms of time and resources, social media offer flexible learning platforms, which might enable teachers to learn continually during their daily practice. They offer collaborative learning platforms, which can be used for ongoing communication, discussion and continuous knowledge sharing. Peer support, collaboration, communication, engaging with new information and knowledge, and generating applicable practice are all possible ways of TPL through social media. However, the literature has also highlighted some challenges regarding learning through social media. Time for engagement, the amount and accuracy of shared information, privacy of participation, limited access in schools and unfocused information were mentioned as barriers to learning through social media.

2.3.6 Rationale for teacher professional learning through social media in environmental education

As highlighted in section 2.1.3, the New Zealand EE *Guidelines* indicate that interdisciplinary, holistic teaching and learning approaches are appropriate for meeting the aims of EE. However, teachers face some challenges integrating EE into school curricula due to lack of support and professional learning (Bolstad et al., 2015). Social media can afford EE teachers the opportunity to engage in professional learning. As social media provide a flexible learning tool and offer accessible material for TPL (Ostashewski et al., 2011), introducing the idea of using social media as a learning platform and tool that enables collaborative learning opportunities in a domain such as EE, in which few formal TPL opportunities exist (Bolstad et al., 2008), is worth considering.

Social media offer an online environment where teachers can collaborate and share effective teaching methods, create a learning community, observe other colleagues' practice and give and receive feedback about different teaching approaches (Greenhow et al., 2018) in EE. In addition, the non-mandatory status of EE in the NZC requires teachers to consider, choose and integrate environmental topics suitable for students in each region. Peer discussion and collaboration through social media may assist EE teachers in finding topics which students are interested in, identifying controversial environmental issues in each region, and choosing appropriate teaching methods. The potential opportunities afforded by social media could help teachers through group discussion or question and answer interactions (Davis, 2015). It helps teachers through sharing problems of teaching specific topics in EE, analysing students' strengths and weaknesses, and engaging in professional learning of teaching strategies. Social media provide opportunities for teachers to disseminate and share their ideas, information and knowledge toward Teaching as Inquiry.

As mentioned previously, the goals of an educational system are student development and high achievement, which are linked to teaching methods. In this study, EE aims to raise responsible citizens who are able to effectively participate in or influence decision-making about the environment (UNESCO, 2002). To that end, students need to be knowledgeable about issues currently facing the environment and gain essential knowledge and skills to influence decisions concerning the environment. Environmental education, therefore, prepares students for their future (Evans, Whitehouse, & Hickey, 2012). This learning process requires group discussion and decision-making skills. The role of teachers is fundamental to this process. For example, teachers may offer some environmental dilemmas or topics for class discussion. Students should be able to understand the issues deeply, be able to analyse the cause and consequences of the issues, suggest solutions for them and convince other groups about their suggested solutions. The role of the teacher is to guide students through this process. To play this role, they need to know about environmental problems locally and internationally (being updated) continually (ongoing) and receive support from experts or colleagues (collaboration) when necessary. Thus, to effectively teach EE through this method, teachers need to receive high-quality professional learning collaboratively and continuously (Dada, 2018). Social media afford opportunities for this by providing teachers with support through interactions with other teachers and experts, as well as resources. Teachers' collaboration

through social media would help them to learn from observing teaching materials (Greenhow et al., 2018; Krutka, Carpenter, & Trust, 2016; Trust et al., 2016).

Success in achieving EE goals depends on EE pedagogical approaches. Key approaches for effective EE engage in transformative, constructive, and participatory education (Medrick, 2013). Empowerment and dialogue in education on the one hand, and lifelong, social, collaborative, problem-based, active, and experiential learning on the other, are emerging themes in the literature on EE pedagogy (Berner, Lobo, & Silva, 2013; Nolet, 2015). Learning through social media is characterised as lifelong, collaborative, and active. In this sense, social media can be regarded as potentially effective for use in TPL in EE. In recent years, furthermore, social media have been used in various social movements (Leong, Pan, Bahri, & Fauzi, 2019), some against major environmental threats, such as climate change. For example, Greta Thunberg uses social media as a platform for calling for action, even in the face of opposition from large corporations and governments (<https://twitter.com/GretaThunberg>).

Transformative learning is an overarching theme for EE pedagogy and either includes all EE pedagogical approaches or all of these are pre-requisites for transformative learning (Berner et al., 2013). In transformative pedagogy, students learn through experience, participation, and reflection (Mezirow, 2000). Transformative learning can be categorised as communicative or instrumental (Mezirow, 2000). “Communicative learning” describes the methods individuals use to communicate their feelings, desires, beliefs, and worldviews. Social media may be useful for transformative learning in this study, as it would enable teachers to share their experience, their feelings and needs regarding teaching and learning EE.

Instrumental learning focuses on learning through real-world experiences (Mezirow, 2000). It is argued that EE pedagogy has the potential to be transformative when learning is experiential in real ecosystems and communities (Alexandar & Poyyamoli, 2014). In experiential learning, students engage in practical activities in the environment where they live, learn, and contribute to the environment (Nolet, 2015). Fieldwork, for example, provides learners with opportunities to be involved in environmental projects, from data collection and analysis to making decisions that will solve real problems in an actual environment (Alexandar & Poyyamoli, 2014). In this respect, social media may be

considered ineffective for learning EE because it is “virtual” and disconnected from the learners’ actual physical environment.

In opposition to this view, it can be argued that while EE includes practical activities in a real environment, learners can use social media to share their experience of those activities with others. For instance, teachers from various educational settings and all corners of the country can speak on various topics related to learning and teaching EE through social media. Teachers can watch segments of EE teaching, and read and hear EE expert perspectives in the field of their interest. Connecting teachers to EE experts would allow the former to ask questions, share their experience and learn from other people’s experience, which in turn could lead to transformational learning. Through social media, teachers have the opportunity to gain knowledge and guidance from other teachers and experts.

Considering the challenges facing our environment, the role of informal learning in EE has been advocated by UNESCO (1977, 2005). Through social media, learning would be an informal and problem-centred approach. This kind of learning offers timely responses to learners’ inquiries and challenges (Greenhalgh & Koehler, 2017). For example, when a teacher faces a new issue regarding a teaching method or environmental knowledge, researching solutions through the use of social media could be an easily accessible option. Building connection between teachers could help them to increase their knowledge and involvement in EE informally, which may enable them to improve their content knowledge as well as their teaching practice in EE (Thacker, 2014).

Teacher professional learning through social media, which facilitate social interaction, is potentially collaborative and is convenient. Social media therefore can help EE teachers to enhance their teaching practices in EE to achieve EE goals. While social media are used for collaborative learning in other disciplines, there is little evidence to support their use in TPL in EE. Therefore, it is essential to understand teachers’ perceptions and experiences of professional learning through social media in EE in order to provide support and TPL for them.

2.3.7 Section summary

Social media have been defined in a variety of ways which are linked to the notion of social interaction. Social media are identified with their affordances for collaboration,

interaction, connection and building communities. Social learning theories explain how social media can afford learning opportunities. The learning theories in this research investigate different perspectives in the process of learning and offer principles to explain TPL through social media. Although social learning theories have been considered in a variety of ways to explain the process of learning, the social features of these theories are intended to apply to collaborative learning through social media in this study.

As learning through social media is collaborative, teachers receive feedback from others, which reinforces their learning. Social Learning Theory underlines the importance of observation. Observation through social media allows teachers to learn from and with one another. Collaborative Learning in constructivism is an effective method to enhance teachers' knowledge and is active and cognitive through experience, interaction, and collaboration. Learning in social constructivism is viewed as a dynamic social activity which occurs in social groups. Collaboration with more experienced teachers or experts through social media would support EE teachers to learn and develop their knowledge and teaching practice.

Collective learning in a LC is highlighted in situated learning theory, in which collaboration enables members to interact and learn together as knowledge is situated in real contexts and settings. Social interaction and collaboration are essential characteristics for learning in situated learning theory. Connectivism describes learning as a process of connecting information, learners and digital devices. Connectivism is a learning theory related to the digital and communication age. Through social media, teachers are able to learn collaboratively through discussions, conversations, and communications since knowledge is distributed. As social media offer worldwide connection and access to a wide range of knowledge, ideas, and resources, they facilitate collaborative learning opportunities between EE teachers and experts in New Zealand. Each of the learning theories discussed holds some potential and scope in relation to social learning and collaborative learning through social media.

2.4 Chapter summary

This study is based on the literature which informed the research. In the study, concepts related to EE, TPL and social media form the research by drawing on different concepts

and theories from the reviewed literature. This literature review has then led to the research gap and demonstrated a need for this research.

The environment is a system that includes natural and social systems with a variety of subsystems. Any changes to one environmental component affect the whole system. Environmental education helps in understanding both the environment and the environmental issues and offers potential solutions to achieve sustainability. Sustainability in natural and social environments is emphasised in the New Zealand education system. Since EE offers a means to develop knowledge and skills towards sustainability, it is recognised as an important part of the NZC, emphasising cross-curricular learning across all educational settings. Teachers face challenges, however, in integrating EE into the school curriculum. To improve EE in schools, TPL plays an important role. It offers teachers new knowledge and skills to enhance their teaching practice and improve student outcomes in EE. Therefore, a significant link can be perceived between TPL and effective EE practice.

Ongoing, collaborative TPL linked to teaching practice can enhance student learning outcomes. Teacher professional learning in a learning community is regarded as an effective method as it is collaborative and ongoing. Teachers are also able to apply their learning to their practice. Collaboration through online communities provides teachers with wider connections, and with more support and resources with fewer restrictions of time and place. Social media have the potential to be used for collaborative and continuous TPL and can provide opportunities for EE teachers to develop their pedagogical content knowledge, which in turn would enhance student knowledge, attitudes, and skills toward sustainability.

Learning through social media is connected to the notion of social interaction and collaboration, which can be explained by social learning theories. Social learning theories therefore offer principles to explain the ways social media can provide learning opportunities through collaboration, interaction, and connection. The social learning theories discussed in this chapter can be applied to the relationships between social media and TPL in EE.

How this was explored in this study is described through the methodology, research methods and research design in the following chapter.

Chapter Three:

Methodology and Methods

3.1 Chapter overview

This chapter outlines the methodology underpinning this study, including an overview of educational research paradigms, followed by the methodology, methods, research approach and research design for this research. Theoretical perspectives in this research are described in the first section, followed by research processes and procedures. This chapter also describes ethical and quality considerations and the research instruments in detail.

3.2 The research paradigm

This study explored teachers' perceptions of professional learning through social media in environmental education (EE) by asking about their perspectives and experiences, and considering interpretations of their experiences. My intention in this study was to understand teachers' perspectives and diverse experiences of teacher professional learning (TPL) through social media by asking them directly. In line with this aim, a significant proportion of the data in this study arose from open-ended questions, through an online questionnaire as well as semi-structured interviews. The research therefore is weighted towards an interpretivist paradigm. Self-reported data gathering methods within interpretivism provide a basis to explore teachers' perceptions of their professional learning through social media.

A research paradigm describes the common beliefs or agreements between researchers concerning how to understand and address problems (Johnson & Christensen, 2012). It can be defined as the thinking structure and alignment of researchers that shape their worldview and behaviour related to research (Jonker & Pennink, 2010; Punch, 2014). Positivism, interpretivism and critical theory are the most common paradigms in educational research (Cohen, Manion, & Morrison, 2011).

The positivist paradigm is a realist and determinist approach, which sees social reality ontologically as objective (Crotty, 1998). This research however is not compatible with a positivist paradigm because it values the subjectivity of participants' perceptions and

experiences of their professional learning through social media. In this study, I was most interested in how TPL in EE through social media is understood and experienced by teachers. The underlying assumptions of this study reject positivist cause and effect relationships between phenomena. Because I was looking at the subjective experiences of EE teachers as a specific group, positivism did not appear the right paradigm for use in this study.

An interpretivist approach focusses on the meaning people make from a situation and behaviour (Punch, 2014). Interpretivist research sees reality as multiple, constructed by people, and considers the role of experiences and social interaction (Crotty, 1998; Wahyuni, 2012). Interpretivist research was considered to be an appropriate ontological approach for this study, because it focuses on people's personal experiences of the world. Social reality is seen as subjective in the interpretivist context (Crotty, 1998; Wahyuni, 2012), and reality is structured by social actors and people's perceptions (Cohen et al., 2011). Therefore, various realities can be identified by interpretivist researchers (Guba, 1990). My intention in this study was to understand and describe the perceptions and experiences of EE teachers regarding their professional learning in EE using social media. As interpretivism does take people's experiences into account, it is seen to be an appropriate paradigm in this research.

Positivist researchers believe that objective methods can be used in social research to examine social questions. Therefore, they adopt the use of quantitative data from experiments, examinations and observations (Cohen et al., 2011). However, in this research, I was interested in teachers' views, perceptions and experiences by questioning them. In the interpretivist paradigm, qualitative data, which includes social structural descriptions, are preferred and can lead to highly specific analyses of social reality (Gray, 2014). Through interpretivism, I was able to derive an understanding of EE teachers' experiences and perceptions of their professional learning. Thus, from an epistemological point of view, interpretivism appeared to be the best approach for this research (Punch, 2014). With regards to the research characteristics, this study is therefore situated within an interpretivism paradigm.

Lastly, critical theory did not appear to be in line with the aims and methods of this study. In opposition to a critical theory approach, which tries to challenge TPL principles and current practice, this research intended to understand teachers' perceptions and

experiences regarding their learning through social media. This research did not intend to bring any changes in teachers' practices, their professional learning, or their views regarding EE. Although in the third phase of the study teachers were introduced to new ways of professional learning in order to experience them for EE, after the study phase, they were free to continue learning through these new ways or not. In addition, while critical theoretical approaches tend to employ observation as a research method (Cohen et al., 2011), in this research study, questioning teachers through questionnaires or interviews was the main data process with no observation of teachers' classroom practice. Therefore, critical theory was not used to frame this study.

3.3 The research approach: Phenomenography

The focus of this study was the ways teacher professional learning through social media were perceived and experienced by teachers. Epistemologically, constructing knowledge in this research project was based on exploring each participant's experiences in terms of TPL through social media in EE. The research attempted to identify the qualitatively different ways in which EE teachers experience and perceive social media as a means to develop their knowledge and enhance their teaching practices. However, this research was not only concerned with differentiating between EE teachers' perceptions and experiences, but was also looking to illustrate common views of social media use by describing teachers' experiences. This research perspective was seen to be closely aligned with a phenomenographic view, as it aimed "to characterize variation in people's experiences" (Richardson, 1999, p. 64) rather than describing diverse individual experiences. Thus, while EE teachers had diverse perspectives and experiences of TPL through social media in EE, phenomenography provided a way of looking at their experiences collectively and holistically (Åkerlind, 2012, p. 116).

Phenomenography is a qualitative research approach within the interpretive paradigm. It aims to explore the different conceptions of a certain phenomenon which are constituted from people's experiences. Phenomenography is used "for mapping the qualitatively different ways in which people experience, conceptualise, perceive, and understand various aspects of, and phenomena in, the world around them" (Marton, 1986, p. 31). Its non-dualistic, ontological viewpoint probes the idea that the world is viewed with different conceptions by people in different situations: "There is only one world, a really existing world, which is experienced and understood in different ways by human beings.

It is simultaneously objective and subjective” (Marton, 2000, p. 105). This non-dualist, ontological view shapes its epistemological stance (Marton & Pang, 2008), which is represented as “an internal relationship between human beings and the world” (Pang, 2003, p. 145).

Knowledge is then relational, created through the interactions and relationships between people (subjects) and the world (object) (Marton, 2000; Marton & Pang, 2008), and it is understood through different meanings of the phenomena associated with people’s experiences (Marton, 2000). Experiences therefore are gained interactively through social interactions and are dependent on both people and the world around them. Understanding the reality of a phenomenon therefore, is only possible through experiencing it (Marton, 2000). A researcher has access to the different aspects of reality through other people’s experiences by using a second-order perspective (Marton, 1981).

The phenomenographical perspective of focusing on respondents’ experiences distinguishes it from phenomenology in educational research. Phenomenographic research thus investigates the relation between participants and the phenomenon under study, rather than the researcher’s own relations to the phenomenon. Despite some similarities, conflicts between phenomenography and phenomenology exist due to their aims in a single study. Phenomenography, as a research approach, offers different methods to understand people’s perceptions and experiences of a phenomenon, while phenomenology, as a philosophical approach, aims to understand the meaning of a phenomenon itself (Marton, 1981; Stamouli & Huggard, 2007). Phenomenology is looking for first order perspectives, through researcher observation, to describe the phenomenon, whereas phenomenography seeks second order perspective, which involves asking participants’ perspectives (Marton, 1981).

In distinguishing the ‘first-order’ and ‘second-order’ perspectives, Marton (1981, p. 171) noted that the first-order perspective for a researcher means being “from the outside” and the second-order perspective means being “from the inside”. For example, in this study, phenomenology would aim to investigate the process of TPL in EE through social media by observing teachers’ activities through social media, while phenomenography aimed at understanding teachers’ experience and perceptions of their professional learning in EE through social media by asking them directly. Furthermore, in comparison to

phenomenology, phenomenography is “more flexible and adapted to the specifics of the phenomenon and situation under investigation” (Forbes, 2012, p. 62).

Considering the strength of second order perspectives to provide insider views for the researcher, and the characteristics of this study, the research from framing the research questions to analysing the data to report writing was designed as a form of phenomenographic research (Marton, 1981). This study seeks to contribute to the subject area using a phenomenographic approach for several reasons: firstly, the study was interested in finding out how EE teachers perceive the use of social media in their professional learning in EE. Secondly, this study intended to understand EE teachers’ experiences of using social media in their professional learning. Thirdly, the study extended this investigation through questioning EE teachers. Fourthly, since I am not a New Zealand teacher, phenomenography provided me with the opportunity of having an insider perception through using second order perspectives. In short, to achieve the research objectives, phenomenography helped me to improve my understanding of participants’ perceptions and experiences of TPL through social media in EE.

In view of the various aspects involved in undertaking phenomenographic research, the study is positioned as developmental phenomenography (Green & Bowden, 2009). This study attempted to find the different approaches that EE teachers were taking in terms of using social media for their professional learning and to enhance their teaching practice. Teachers’ diverse experiences of using their learning to improve their teaching practice, have in turn, helped the improvement of students’ learning outcomes in EE. In addition, the research intends that teachers’ perceptions and experiences of TPL through social media in EE can provide a model for TPL, which can in turn improve education.

3.4 My position as a researcher

By conducting this study in a New Zealand context, I acknowledge myself as an outsider. My position means that I started this study knowing little or nothing about EE in New Zealand. Insiders may have experience and knowledge of EE in the New Zealand education system that influences their research, whereas as an outsider I have not had this influence. This positioning involves some advantages and disadvantages (O’Leary, 2010). Conducting the research in a New Zealand context has the advantage of establishing a study with limited bias. The research, from designing a questionnaire to report writing,

was planned to capture only teachers' perceptions and experiences. Insiders may already be familiar with the possibility and barriers of TPL through social media for New Zealand teachers. They may have already experienced some challenges, whereas, as an outsider, I have asked teachers with no partiality. Therefore, my position as an outsider has been altered by my research participants' experiences, and my focus on seeing things from the perspectives of EE teachers within the New Zealand educational setting.

However, due to my unfamiliarity with the New Zealand education system, I was not equipped to deal effectively with teachers' concerns and questions regarding EfS Achievement Standards in Phase three of the study. For example, in working with secondary school teachers through Google+, my lack of knowledge about EfS Achievement Standards prevented me from answering teachers' questions actively. This made the research process more difficult due to my lack of pedagogical content knowledge (PCK) in New Zealand and EE structures.

To gain an insider view, phenomenography was utilized as a research methodology in this study. A second order perspective in phenomenography enabled me to view the phenomenon through my participants' eyes to understand teachers' perceptions and experiences of their professional learning through social media in EE.

3.5 The research design

Considering the research ontological and epistemological perspective discussed earlier and aligned with the research questions, the study was framed as mixed methods outlined in three phases (Figure 3.1), with each phase involving different steps (see Table 3.1). In line with the interpretivism paradigm which allows exploring the participants' perspectives, a questionnaire was used in the first phase to provide a broad view of teachers' perceptions of professional learning through social media. Although a significant proportion of the data in this study, particularly in phase one, were from the questionnaire, the questions were mostly subjective, revolving around participants' perceptions and experiences. To this end, I intentionally did not ask knowledge-based questions through the questionnaire.

The questionnaire provided both quantitative and qualitative data from EE teachers in different educational settings. Phase one also provided a basis for the interview questions in Phase two. The second phase was a qualitative study based on interviews. Findings

from the first and second phases informed the design of the Learning Community through social media in the third phase. This section describes the sampling, methods, data collection and analysis for each of these phases.

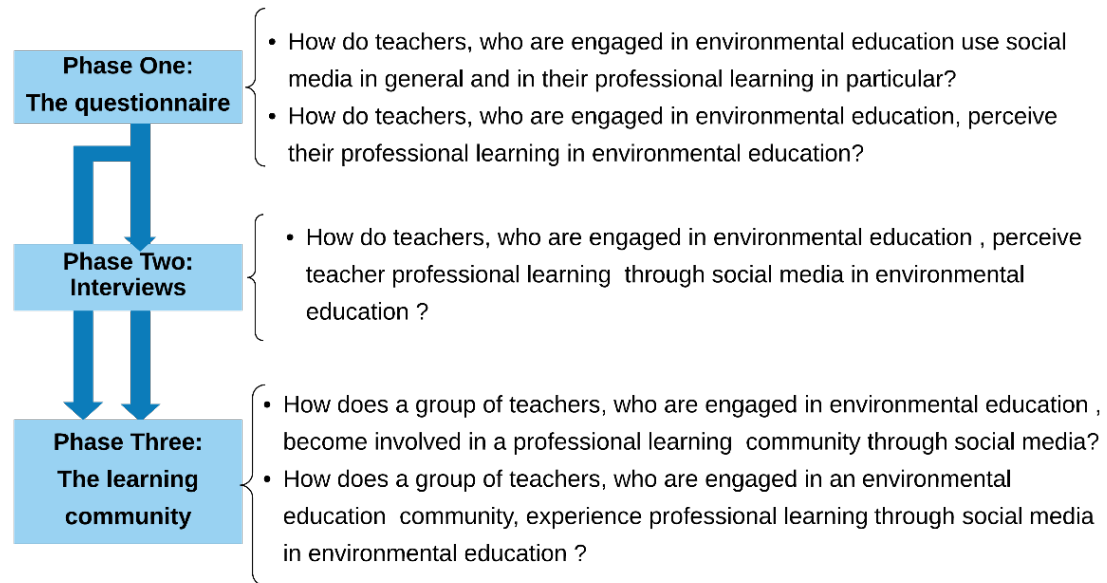


Figure 3.1 The research question(s) in each phase

Table 3.1
Research design

Phase	Methods	Description of steps	Data analysis	
1	Questionnaire	Online questionnaire Data analysis Interpretation Determine next phase	Statistic &	Thematic
2	Interview	Semi structured interview Data analysis Interpretation Determine next phase		Thematic
3	Document analysis & Interview	Set up a learning community Document analysis Semi structured interview Data analysis Interpreting of data		Thematic

3.5.1 *Phase one: Questionnaire*

As there was no similar study published, the purpose of this phase was to provide an overview of teachers' perceptions of professional learning through social media in EE as well as providing background information for the research. To this end, Phase one addressed the first and second research sub-questions regarding the use of social media amongst New Zealand teachers who are engaged in EE, and their perceptions and experiences of professional learning in EE. In order to achieve this purpose, the lead teachers² from Enviroschools all around New Zealand were invited to participate in this study by responding to an online questionnaire. The research method and process in Phase one are presented in this section.

3.5.1.1 *Research method*

As the study intended to collect data from all Enviroschools lead teachers from all around New Zealand, a questionnaire was used as it can be quickly and effectively administered to a relatively large population to provide data (Burton & Bartlett, 2009). Questionnaires are mainly used to convert the purposes and objectives of studies into particular questions that can generate specific responses (Creswell & Creswell, 2005; Neuman, 2006). Furthermore, questionnaires can be used to obtain information about participants' perceptions (Johnson & Christensen, 2012). In addition, questionnaires are regarded as important data collection tools within social and educational research (Cohen et al., 2011; Johnson & Christensen, 2012; Neuman, 2006), and also as traditional instruments in the area of communication and media research (Jensen, 2013).

This phenomenographic study intended to use a questionnaire to gather teachers' background information and to gain a view of how they use social media in their professional learning in EE. In line with the study's phenomenographic approach this information was planned to inform the more intensive interviews in Phase two and designing the learning community in Phase three. The particular methodological approach selected for the study, and the nature of the research questions, along with the research paradigm, shaped the arrangement and content of the questionnaire in this study (Gall, Borg, & Gall, 2007). Since no similar study has been done in EE, there was no

² In the New Zealand education system "the term lead teacher is used to indicate a mentoring, coaching role where the expertise of the designated teacher is used to support the development of others" (Parr, 2009, p. 10).

relevant questionnaire that could address the various aspects of this research. Therefore, the questionnaire designed for this study was carefully crafted in a way that would be most useful to capture teachers' views, and generate data around their social media usage, teacher professional learning, and teacher professional learning through social media, as well as teachers' perspectives on EE. Most of the given questions were designed in relation to the literature on TPL and social media. The general structure of the questionnaire is described in Table 3.2

Table 3.2
Sections of the questionnaire and their descriptions

Key conceptions	Descriptions
Introduction	To inform participants of the study aim, description of TPL and social media in the study context, and the study ethical considerations
Demographic section and Background information	To break down data into different groups in order to identify particular subgroups of participants
Teaching information	To break down data into different groups in order to provide different categories of data
EE teachers' social media usage and its use in their professional learning	<p>To gather background information about teachers' social media usage, such as the most popular platforms among teachers</p> <p>To determine teachers' preferred platforms for different purposes</p> <p>To guide interviews in the next phase.</p> <p>To rate the importance of social media used by EE teachers</p>
Teacher professional learning approach, effective teacher professional learning and the importance of teacher professional learning in EE	<p>To find teachers' perceptions of effective TPL methods in EE.</p> <p>To provide an overview which may help to overcome teacher professional learning challenges in EE.</p>
TPL in EE through social media	<p>To access evidence for TPL in EE in New Zealand context</p> <p>To provide an overview of teachers' perceptions of professional learning through social media in EE</p> <p>To identify possible issues that the researcher had not predicted.</p> <p>To design the next phase of the study</p>

The questions probed teachers' views about social media in relation to TPL in EE; investigated its place in their professional learning; and investigated their current use of social media for these purposes. The questionnaire was also designed to capture teachers' perceptions and experiences regarding TPL in EE. The questionnaire comprised 21 questions divided into six sections (see Appendix A).

In order to provide qualitative and quantitative data, both open and closed questions were included in the questionnaire. As I expected many respondents to contribute to this study, closed-ended questions were mostly used to gather teachers' background information, their social media usage patterns, teachers' perceptions and experiences of TPL in EE, and their perceptions about using social media in their professional learning in EE. Closed questions can easily be analysed for quantitative data obtained from a wide range of participants. Closed questions also allowed the participants to answer easily and in a time-saving manner. Open-ended questions were employed in the last section to obtain teachers' reasoning regarding the topic. Open-ended questions provided an opportunity for participants to explore some themes in more depth. Therefore, the respondents were able to state a number of issues that the researcher had not predicted, as they enabled respondents to write about whatever they regarded as relevant to the questions they were answering (Burton & Bartlett, 2009; Neuman, 2006).

The questionnaire was reviewed by one expert in the field of EE, one in the field of TPL, and one with statistical proficiencies. The experts were requested to provide recommendations and suggestions to improve the clarity of the questions. Before commencing the study proper, a pilot test was conducted among six teachers who were engaged in EE. They reported that they could complete the questionnaire without difficulties in 15-20 minutes. The pilot test was very helpful for rewording and clarifying the questions as suggested by some of the participants. Pilot questionnaire responses were not considered as data sources in this study.

3.5.1.2 Sampling and data generation

The target population in this research was New Zealand teachers who were engaged in EE. Therefore, Enviroschools' lead teachers from all around New Zealand were considered as potential participants in this study. The number of Enviroschools in New Zealand was reported to be 1000 in 2015 (Enviroschools, 2016). Studies have found that

unsolicited online survey return rates averaged 10 per cent (Witmer, Colman, & Katzman, 1999). With this assumption, the expectation was to receive approximately 100 responses from the Enviroschools. Volunteer sampling was used and an online questionnaire sent to all Enviroschool lead teachers all around New Zealand (Cohen et al., 2011). The sampling method in this research therefore involved EE teachers who agreed to participate in the study. The participants were teachers who engaged in EE in different educational settings, including early childhood, primary school, secondary school, intermediate schools, and area schools. As the study involved Enviroschools' lead teachers from all around New Zealand, it was planned to invite the lead teachers from all Enviroschools. Therefore access to participants to conduct the study was required. In this regard, the National Director of the Enviroschools Programme was approached to ask for permission and for access to the EE teachers' email addresses. After gaining permission and access to use the Enviroschools' email list, an invitation with the study information sheet and a link to the questionnaire on SurveyMonkey was emailed to the EE teachers nationwide via Enviroschools staff (Appendix B).

As the email list contained a large number of addresses, MailChimp was used to create an email list and follow the delivery process. MailChimp is a marketing automation platform which is used to share emails, advertisements, or messages (Mailchimp, 2017). Out of a total 1083 emails sent, 964 emails were delivered successfully. In this stage, the email list was checked again, and incorrect email addresses were removed. A reminder to consider completing the questionnaire was sent two weeks later to 1015 recipients (Appendix B.1). A second reminder was sent two weeks from this first reminder (Appendix B.2). The questionnaire was available online for six weeks, and received 194 responses in total during that time. Overall, the questionnaire return rate was almost 20%. The process of collecting data is presented in Table 3.3.

Table 3.3
Data collection procedure

	The initial invitation 27/2/17		First reminder 13/3/17		Second reminder 31/3/17	
	Number	Percentage	Number	Percentage	Number	Percentage
Recipients	1083		1015		1011	
Successful deliveries	964	89%	954	94%	949	94%
Responses rates	106	11%	71	7.4%	17	1.8%

3.5.1.3 *Data cleaning and preparation*

The questionnaire received responses from 194 EE teachers. Later, out of 194 returned questionnaires, those which only included six or less completed questions were deleted from data pool. Having done that, the number of research participants for the statistical analysis was reduced to 176.

Quantitative data from the closed questions were put into Microsoft Excel and transferred to Statistical Package for Social Science (SPSS) for further analysis. This step also involved reviewing the data for consistencies, in order to remove inconsistent data such as out of range or extreme values in some questions. However, the study did not find out of range data in the data set.

3.5.1.4 *Data analysis*

The questionnaire was designed to gather both quantitative and qualitative data. As each data set requires specific methods of analysis (Punch, 2014), both quantitative and qualitative data analysis methods were utilised in this study. Quantitative data from questionnaires were processed and analysed using the SPSS 22 and Microsoft Excel 2016, and qualitative data which emerged from open-ended questions were analysed using a computer-assisted qualitative data analysis software (NVivo11). Selecting a data analysis strategy and choosing appropriate statistical approaches were done based on the nature of the research questions, methodology, and the characteristics of the data.

Quantitative data analysis

This research involved studying how teachers described their perceptions and experiences of TPL through social media in EE. Therefore, for quantitative data analysis, descriptive statistics, which enabled me to summarise data sets, were used to provide insights into the collection of data. In contrast to inferential statistics, which are based upon the researcher's perspectives, descriptive statistics help to identify participants' perspectives and characteristics. In inferential statistics, the main conclusions and what the researcher expects to learn about the collected data are gained by analysis of the means from different statistical tests, while descriptive statistics help to identify sample features such as overall sample size or demographic characteristics of received data (Pallant, 2010). As a phenomenographic research study, there were no predetermined expectations regarding TPL through social media in EE. Thus, the nature of the research did not require any inferential statistical tests. Descriptive statistics, on the other hand, did provide a quick summary of the characteristics of different variables and statements in this study (Pallant, 2010).

Qualitative data analysis

As mentioned, four open-ended questions were used in the questionnaire to provide an opportunity for teachers to express their views regarding the research questions. The participants' answers to these questions were considered a main qualitative data source in this study. As there was no structure or framework prior to data analysis and there was no predetermined theory in this research, an inductive approach was used as a means of data analysis (Burnard, Gill, Stewart, Treasure, & Chadwick, 2008). Therefore, qualitative data generated from open-ended questions across the questionnaire were analysed through inductive thematic analysis (Boyatzis, 1998; Burnard et al., 2008). To this end, the qualitative data were categorised, reviewed, and interpreted in relation to the research questions (Cohen et al., 2011; Punch, 2014), and the research methodology (Lacey & Luff, 2001).

Participants' responses suggested a number of themes which shaped findings in this research. The process of analysing qualitative data in this research involved reviewing, coding and recoding all open-ended questions from questionnaires to find the patterns of data and to structure the findings (Guest, MacQueen, & Namey, 2011).

To begin the data analysis, I created a different word document for each open ended question. Analysing data then continued through reviewing teachers' answers to each question to find the patterns in the data. Participants' answers to the open-ended questions varied from a single-word to a few sentences. Answers with similar meaning were grouped together into different categories regardless of their length. Nvivo 11 pro (a computer software package for qualitative data analysis) was used for coding in order to develop themes within the answers. It made the process of re-coding and contrasting themes to identifying possible themes easier (Bazeley & Jackson, 2013). NVivo also was useful to save data from Phase one for further analysis in Phase two (Bazeley & Jackson, 2013).

Coding was done to capture themes emerging from participants' responses. These themes were used to continue the research into the second and third phase and design interview questions. Data analysis in Phase one was completed once Phase two data was gathered.

3.5.2 Phase two: Interviews

Data drawn from the questionnaire provided foundational information for continuing the research process in Phase two. The purpose of this phase was to probe, in depth, teachers' perceptions of EE professional learning through social media, and to explore participants' social media usage for their EE learning through clarifying the emerging findings from Phase one. Accordingly, the types of questions and interview items were constructed based on the research findings in Phase one.

3.5.2.1 Phase two participants

Participants in Phase two were five individual teachers who took part in Phase one and who had indicated their willingness to participate further in this study. The research participants are identified here by their self-chosen pseudonyms — Blake, Margaret, Karen, Geoff and Helen. Table 3.1 presents a brief description of the research participants in Phase two. An in-depth description of participants is provided following the table.

Table 3.4
Description of the research participants

	Age	Teaching experience	Engaged in EE	Educational setting
Helen	45-50	13 years	3 years	Area school (mostly secondary)
Blake	35-39	7 years	7 years	Secondary school
Karen	55-59	26 years	20 years	Primary school
Geoff	35- 39	4 years	4 years	Primary school
Margaret	35-39	14 years	5 years	Early childhood

Helen

Educated in environmental science, Helen was an EE lead teacher in an area school, mostly teaching EfS Achievement Standards and Personal Action Units for years 12-13 (16-17 year olds). She was interested in the social aspects of EE and enjoyed teaching Māori (indigenous peoples') Perspectives in her combined year 9 and 10 class. In her free time, she was involved in a local Bat Recovery project and the Forest and Bird Society (Royal Forest and Bird Protection Society of New Zealand). She was a member of the Lions Club, which focuses on community service and strengthening the community.

Helen considered EE to be an important skill which should be integrated into all subject areas. As she said in her interview, "EE would help kids to collaborate, solve problems and be part of a community" (Interview). For her, EE therefore involved acquiring knowledge and skills which could equip students for the 21st century.

Although she had both a Facebook and a Google+ account, her preferred social media platform was Facebook. She employed Facebook mostly for personal use as well as for learning in various subject areas but not for teaching. She used Google+ professionally for learning and as a member of a learning community. Accordingly, she would check

Facebook every day and her Google+ account only occasionally. Drawing upon her experience, she had a positive view of the use of social media for learning.

Blake

Blake was a secondary school teacher in a remote area who taught EfS Levels 2 and 3 for year 12 and 13 students. He was the lead teacher for his school's major EE project in the local area. His school was a silver EnviroSchool and his goal was to help it become a centre of environmental excellence. Consequently, he was trying to find ways in which EfS could be integrated into the school curriculum and across all subject areas. His engagement in EE was not only through the school but also in his active membership in various environmental programmes. For example, he would help other schools with conservation education trips. He was a member of various national programmes that are actively involved in environmental activities.

For Blake, EE involved learning about environmental issues, their causes, and practical ways to overcome the resulting challenges. EE therefore did not mean simply talking about contemporary world problems. He believed it was important "that our students understand why environmental issues, such as climate change or water quality, are important and start thinking of ways to solve them" (Interview).

Among his social media accounts, Facebook was a platform he used regularly, drawing on it for learning in general and for EE in particular. He was not active on Google+ but would check other people's posts often. He had an Instagram account but was not interested in checking Instagram posts.

Karen

Karen was an experienced teacher who worked in a small primary school in the country. She believed that in primary school, EE is mainly implemented incidentally through the science curriculum, during talks about animals and plants or living things but also as part of literacy, through writing, reading and poetry.

As part of the EnviroSchool programme, EE in her school was considered an important whole-school approach and involved practical learning through the development of wetlands, working on the farm, and planting. Reflecting its cultural perspective, the school tried to bring cultural and social aspects relating to the environment to school

activities, such as planning for Matariki (a Māori New Year celebration in late May or early June) and asking Māori people to recite *karakia* (prayer) before planting. She was involved in environmental programmes and groups in her personal life, for example in her membership of the Royal Forest and Bird Protection Society of New Zealand.

She believed EE to be an important topic which enhances the quality of the environment and of our lives. She maintained in her interview that “making students aware of the choices that they could make through EE would enable them to be socially and environmentally aware of issues. They need to learn and be aware of environmental issues as these are the children's issues in future” (Interview).

She had Facebook and Twitter accounts. She used Facebook daily to interact with her family and friends, and Twitter to keep track of school activities and to send and receive messages from school. However, she would use Facebook to find other ideas through the New Zealand teacher Facebook page. In their school, they also use Seesaw Blog to show children's learning to whanau (family) and to share school activities. She was not aware of any specific EE teacher group for learning through social media.

Geoff

Geoff was a lead teacher and head of science in a small Enviroschool in a rural area. River restoration was the major project in his school and as an Enviroschool lead teacher, he was heading up the project. In his school, EE involved various hands-on activities, such as gardening, killing pests, tracking, weeding, water quality measurements and planting native plants.

In addition to serving as an EE teacher, Geoff was engaged in various environmental activities, mostly teaching himself in order to improve his knowledge and skills as a teacher. He considered EE to be an important interdisciplinary approach. “Reading, writing, and math are separate subjects and EE brings them together and gives them a way of focusing those three as skills and having a reason for learning them” (Interview). He believed EE could give a meaning or spirit to other subjects. For example, he explained, “when students learn about kauri snails, EE makes this learning important. Because they need to learn reading in order to gain knowledge about kauri snails, they should write a letter and explain it. Environmental education has practical uses for what they're learning in other subjects” (Interview).

He had a Facebook account and used it every day to keep in touch with family and friends, as well as for learning. He used Facebook to follow a number of pages for professional learning in EE. Overall, he was an active Facebook user for learning as well as teaching. He also made frequent use of YouTube for both learning and teaching.

Margaret

Margaret was a teacher in an early childhood centre. Environmental education in her school involved discussing the subject and teaching children how to take care of the environment, including teaching Māori concepts of the environment and *kaitiakitanga* (guardianship), mostly by role modelling as well as in practice. Her personal interest in EE involved being outdoors and pro-environmental behaviour, including conserving water and other resources. She was not part of any environmental groups or activities.

She believed that environmental problems were increasing in our world and that the role of EE in education was essential because children would be the key factors for sustainability to save the Earth. For Margaret, EE involved not only knowledge about the environment but also being concerned about it and the ability to care for it, including its natural resources and people.

She had a Facebook account and Twitter. Facebook was her main platform for both personal and professional use; for personal use every day, and for work once a week. She also had a Twitter account because the early childhood centre used Twitter.

For professional use, she was interested in using social media on a global scale. Sharing and gaining ideas and keeping informed about environmental news and activities were her reasons for using social media. To this end, she would follow particular Facebook pages, such as the Te Papa Facebook page (<https://www.facebook.com/TePapa/>), or the Forest and Bird Facebook page (<https://www.facebook.com/forestandbird/>). She was also interested in watching videos on YouTube and Facebook. However, she believed the current use of social media for learning, especially in early childhood, was not collaborative.

3.5.2.2 Data generation in Phase two

As highlighted, Phase one findings provided a foundation for Phase two. Phase two was based on interviews to further explore research findings from Phase one.

Interview

The interview is a method for collecting data by asking questions (Johnson & Christensen, 2004) and is commonly employed in social and educational research (Burton & Bartlett, 2009; Punch, 2014) to access participants' perceptions of certain subjects (Punch, 2014). The interviewer can ask the participants both open and closed questions (Creswell, 2013; Punch, 2014). Interviews can be of various types: structured, semi-structured, unstructured, and interviews of focus groups. In a structured interview, the researcher determines in advance the themes, issues, and all the questions (Cohen et al., 2011; Punch, 2014). In an unstructured interview, open-ended and in-depth questions afford opportunities for participants to provide detailed answers (Punch, 2014). A semi-structured interview provides elements of both the first two types, with predetermined themes but also the flexibility to gain detailed or alternative responses. In all interview types, however, the researcher has to ensure that the research objectives are achieved through interview questions (Cohen et al., 2011).

Since interviews can be useful to follow up responses given in questionnaires and can provide further data (Burton & Bartlett, 2009), this study benefited from adopting the interview as the research instrument in Phase two. Interviews in this study provided the opportunity for the researcher to find out more about the participants' experiences and perceptions (Punch, 2014) of professional learning through social media. Semi-structured interviews were therefore used to afford teachers more opportunities to express their perceptions and experiences in using social media in their learning. Most of the interview questions focused on issues that emerged from the previous phase of the study. Semi-structured interviews were conducted to gain insight into teachers' experiences using social media, the ways they use social media to collaborate and cooperate, and how they perceive learning collaboratively in EE. Through semi-structured interviews I was able to ask questions based on findings from Phase one. Also, I gained new information through asking different questions.

Design and development of interview questions in this study

Particular consideration was given to the methodological approach for the research while selecting and designing research instruments in general and interview questions in particular. With reference to the previous section, this study adopted a phenomenographic

approach. This approach adopts a second order perspective to collect data. Toward this end, the data collection methods in Phases two and three consisted of semi-structured interviews with a small number of participants (Marton, 1986). Data gathering following this approach was a “process of discovery, concentrating in the first instance on each individual as a separate case” (Ashworth & Lucas, 1998, p. 418). The interview questions were based on EE teachers’ own experiences and perceptions of the context, since teachers have unique experiences of the use of social media for learning purposes in EE.

Another key aspect of phenomenographic research is bracketing. Bracketing means categorizing participants’ points of view and assumptions, without any intrusion from the researcher’s assumptions and interpretations (Ashworth & Lucas, 1998). This strategy was used to avoid possible researcher preconceptions while interviewing participants. Accordingly, the researcher bracketed preconceived ideas, theories and previous research findings, and focused only on similarities and differences between participants’ perceptions and experiences (Ashworth & Lucas, 1998) of TPL through social media in EE. Findings from Phase one made the process of bracketing easier. It should be noted that in keeping with the research methodological approach adopted, bracketing was followed in all stages of this thesis, from the initial design, to interviewing and data gathering, data analysis, and reporting the findings.

In addition, as a key feature of phenomenographic research, interview questions were piloted before conducting interviews, to detect weaknesses in interview questions and to improve the researcher’s interview skills. Piloting the interview questions means finding out if questions work in a real study context by testing them first on a few people. Bowden (2005, p. 19) explained the essential role of piloting the interviews was to improve interview skills and “to ensure that the topic that interviewees are encouraged by the planned inputs to discuss is the topic that is the subject of the research.”

Another purpose of the pilot interviews was to examine the interview questions in terms of the estimated length of time and to trial the choice of interview methods, for example, testing that interviews could be conducted effectively via Skype or phone. In addressing this purpose, two pilot interviews took place, one of which was conducted by phone and one via Skype. Participants involved in the pilot interviews included two PhD students in EE. Data from pilot interviews were discarded from the data sample. This is because the target participants in this study were EE teachers, not PhD students. Following the pilot

interviews, most of the interview questions remained unchanged and 20-35 minutes was estimated to be a suitable length of time for each interview. Piloting was also used as a technique to test the validity of the research tools in order to enhance the reliability of the interview data (Punch, 2014). Piloting the interview questions therefore led me to rephrase some questions where necessary (Green & Bowden, 2009). It made the process of interviews and its following phase, data analysis, easier and more straightforward.

Together with the research questions, the methodological approach selected for the study framed the arrangement and content of the interview questions. Apart from the introduction, the interviews comprised 20 questions divided into six sections (see Appendix C). The introduction dealt with ethical concerns and the time required for the interview. Section I outlined the background questions and information about the teachers' work, such as years of teaching experience and the educational setting in which they currently work. In Section II, participants were asked to talk about EE in their school and in the New Zealand curriculum. Section III focused on eliciting participants' perceptions and experiences of TPL. Section IV dealt with information on social media usage among participants in general and learning through social media, particularly in EE. Section V concentrated on clarifying the findings from the questionnaire. In the last section, participants were asked to indicate their view of TPL through social media.

Data generation process

Volunteer sampling was used in this phase of the research and involved selecting participants by asking for volunteers (O'leary, 2004). To this end, as part of the initial email in Phase one, teachers were asked to express their interest in further engagement in the research. The researcher's email address was provided, and participants were asked to email the researcher if they would be prepared to continue to engage in the research in the next phase. It was explained that the interview would focus on their perceptions and experiences of using social media for professional learning and teaching practice in EE. It was left to participants to determine what interview method they preferred, as well as the date and time of the interview.

As the interviewees lived in different parts of New Zealand, the interviews were carried out via Skype, Zoom and by phone, based on the participants' preferences. The date, time, and interview method were discussed with the volunteers via email one week prior to the

interview date. Prior to the interview, an information sheet and consent form were emailed to the volunteers. For the convenience of participants, interviewees were asked to indicate their consent by email. The information sheet provided a brief description of the research purpose, study design, and relevant ethical considerations. Participants were informed that their responses would be kept anonymous, private, and confidential. The information sheet also contained the explanation that the study was concerned with teachers' perceptions and experiences of professional learning through social media in EE. Also, a reminder and confirmation email were sent to the interviewees one day before each interview. The process of interview preparation for each interviewee is presented in Table 3.5.

To address ethical considerations in this research, the researcher confirmed with interviewees that they had understood the information sheet before commencing the interviews. In the introduction, the researcher gave participants the opportunity to raise any queries or concerns regarding the research or their anonymity. However, none of the participants requested further clarification. The semi-structured interview probed the teachers' perceptions of their interactions through social media for learning purposes, as well as their experiences of using social media for interaction, cooperation and collaboration for professional learning in EE. Participant responses opened up avenues for further in-depth questions, based on their concerns and interests. Due to the nature of social media, however, there are collective experiences in their use for TPL in EE. Therefore, to find the key aspects of variation in TPL through social media in EE, teachers were asked to elaborate their own ways of using social media for learning, without expecting them to experience it in similar ways or in specific directions.

With participants' permission, audio recordings were made and interviews were transcribed verbatim in order to avoid any loss of information (Johnson & Christensen, 2012; Punch, 2014). Later, the interview transcripts were emailed to the participants for them to check the accuracy of what had been recorded in order to enhance the validity of the data (Guba, 1981). As Lincoln and Guba (1985) suggest, participant validation is the best technique for establishing credibility. Validation was valuable for rewording and clarifying some expressions and technical terms, as suggested by some of the participants.

Table 3.5
The process of interview preparation

Participants	Email from volunteer	Invitation & consent to volunteer	Consent from volunteer	Method	Date, time
Karen	25/04/17	25/04/17	1/05/17	phone	9/5, 10am
Margaret	27/4/17	1/5/17	1/5/17	phone	9/5, 2pm
Geoff	18/4/17	1/5/17	8/5/17	phone	10/5, 2:25pm
Blake	1/5/17	1/5/17	2/5/17	Skype	11/5, 9:05am
Emma	1/4/17	24/04/17	8/5/17	Zoom	12/5, 1.15pm

3.5.2.3 *Data analysis*

As shown in Table 3.5, interviews were scheduled from 9th to 12th May, 2017, at times that were most convenient for the interviewees. The set times were only for gathering data since it was difficult to complete the transcriptions on the same day as the interviews. Therefore, interviews were transcribed within 2 weeks following completion of the final interview. Having done that, interview transcripts were sent to the interviewees for member checking. Participants were given 2 weeks to determine if their shared perceptions and experiences had been accurately reported. Except for some suggestions regarding terminology, no issues arose from the participants' point of view.

An inductive thematic analysis was used to capture the intricacies of meaning within the interview data in this phase of the study. Analysing data in this phase involved categorizing the various aspects of TPL in EE through social media to explain findings from Phase one. As highlighted, teachers' responses to the open-ended questions in Phase one were a main qualitative data source in this study. Through NVivo, I was able to save and organise qualitative data from Phase one for further interrogation for an ongoing process in Phase two (Bazeley & Jackson, 2013). As with data which emerged from open-ended questions across the questionnaire, the interview data were analysed through inductive thematic analysis (Boyatzis, 1998; Burnard et al., 2008).

The process of analysing data in this phase therefore involved recognising important themes within participants' answers by reviewing and coding interview transcripts. As in Phase one, NVivo was used in this phase to organise data. The process of data analysis started with transcribing interviews using NVivo. I improved my understanding of teachers' answers to the interview questions through reading the transcripts (Maguire & Delahunt, 2017). Then, codes, categories and themes were generated. NVivo also enabled me to find the themes by providing an overview of teachers' responses to each question prior to coding.

Although findings from the previous phase indicated a variety of themes and subthemes, I did not focus on those specific aspects of the findings that were determined prior to data analysis in Phase two. I looked at Phase two data as a new source of information to find the pattern within participants' perceptions. Findings from interviews were in line with previous findings and were used to complete the study findings. Even though the participants had engaged in EE and social media, they provided different perceptions and experiences on the use of social media for their professional learning. Their descriptions of these experiences and perceptions were used as direct quotations to support the research findings.

To address the issue of research quality and in conformity with the research theoretical approach, especially the question of its confirmability, the categorizing of participants' perceptions was done without the researcher's assumptions and interpretations intruding (Ashworth & Lucas, 1998). Extraneous ideas, theories and previous research findings were not considered and I focused only on similarities and differences between participants' perceptions and experiences while analysing and reporting data (Ashworth & Lucas, 1998). The information generated in this stage, in line with findings from Phase one, led the research to the next phase.

3.5.3 Phase three: The learning community

To address the research aims, data drawn from previous phases was used for continuing the research process in Phase three. The purpose of Phase three was to support EE teachers who were engaged in EfS (education for sustainability) Achievement Standards, at the senior level of high school, by providing synchronous and asynchronous learning opportunities. Teachers' experiences as members of a collaborative learning community

would help me to understand and describe teachers' perceptions of professional learning through social media. Accordingly, for Phase three a learning community using Google+ was set up. This section briefly describes the process and procedure of the third phase of the study from planning to data analysis. Further detail is presented in Chapter 6.

3.5.3.1 *Planning*

Planning and designing Phase three was started with a review of findings from previous phases of the study. Findings were summarized into different categories to apply in the third phase (see chapter 6). The third phase of the study continued by looking for volunteers to take part in a professional learning community of secondary school teachers through social media. To this end, the Waikato Enviroschool Project Coordinator was approached for assistance regarding sending an invitation to secondary school teachers. A call for participation was sent out to all secondary school teachers who were engaged in EfS Achievement Standards on 4 September 2017 through Enviroschools' email (See Appendix D). Environmental education teachers were encouraged by the Enviroschool Project Coordinator to get in touch with me regarding their involvement in the third phase of the study. However, I didn't receive any responses from teachers. In the interim I emailed two secondary teachers who had participated in Phase two interviews and asked them if they would be willing to take part in the last phase of the study. Blake and Helen, who had participated in both Phase one and two, agreed to continue their involvement in Phase three.

In line with the study's methodological approach, I held a meeting with the participants and my chief supervisor to discuss the implementation of findings from Phase one and Phase two to create a community and to choose a platform. The online meeting was conducted through Zoom on 12 October 2017. The online meeting provided participants with the opportunities to know other members of the learning network and to share their concerns and ideas. We also discussed findings from Phase one and two in order to choose a suitable platform for TPL in EE. Finally, a learning community for secondary school teachers who were engaged in EfS, and EE experts was launched through Google+ to connect EE teachers and experts. Table 3.6 shows the first steps to establish this community.

Table 3.6
Steps to the EEfS establish Google+ Community.

Date	Activity	Target group	Outcome
4/09/17	Call for participation	Enviroschool secondary contacts	No responses
14/09/17	Call for participation	Phase two interviewees	Two responses
12/10/17	Zoom meeting	Volunteers (Helen and Blake)	Planning a learning community
22/10/17	EEfS launched	The community members	Collaborative TPL

3.5.3.2 *The EEfS Google+ Community*

The Environmental Education for Sustainability (EEfS) Google+ Community was launched with six members (two teachers, my supervisors and I) as a collaborative learning community via Google+ on 22 October 2017. However, because the community involved only two EE teachers, it was smaller than necessary to build wider learning. In order to bring the community to life and encourage more teachers to join, a cover image and a description was added to reflect the community's purposes and objectives. As part of the community description, potential participants were informed about what they could expect from joining the EEfS Google+ Community. It was clarified that the EEfS Google+ Community would be a learning network for EE teachers where they are able to share their experiences, challenges, resources, and thoughts regarding learning and teaching EE. It was also mentioned that their posts needed to be interactive and professional.

In addition, to give the community a cohesive feel, EEfS was chosen as the community name because it recognised both the historical use of EE and the government's use of EfS (see section 2.1.5, chapter 2), combined into the use of EEfS in the most recent national strategy. However, the members were free to use any name or acronyms they liked, or felt more comfortable to use in their posts and discussions. In order to start and help to run a learning community, I designed a holistic strategy for the community before sending out the invitations. The strategy for administering the community was finalised on 9 November 2017 (see Appendix E). The strategy clarified the members' tasks and my

responsibility as an admin person. The community strategy provided a comprehensive plan for the duration of Phase three, as well as the reasons for having Google+ as a learning platform. Yet, unpredictability was considered as part of the strategy, and setting a weekly plan based on teachers' interests, wants and needs was considered as well. In short, the learning community strategy reflected the research findings, and was created based on strategies suggested by research participants in previous phases of the study.

Apart from the inclusive strategy, it was also planned to have monthly strategies in order to reflect the members' ongoing activities and discussion. As part of our monthly strategy, a further call for participation was sent to individual teachers by the community members. The number of members increased to 17, including eight teachers. Four of the teachers, however, were not engaged in the community activities and I did not receive their consent to use data from them.

3.5.3.3 *Participants*

Participants in Phase three were four secondary school teachers who were engaged in the EEfS Google+ community and indicated their willingness to participate in an interview (Table 3.7). These four teachers are identified by their self-chosen pseudonyms as Helen, Blake, Juno, and Bruce Wayne. A description of the participants in the EEfS Google+ Community, including the community members and the research participants in Phase three, is provided in Chapter 6.

Table 3.7
Phase three participants

Name	Being engaged in EE	Subjects	Joined the Community	Interview method	Interview date
Helen	Four years	Science, Mathematics	Oct 17	Zoom	24/7/18
Blake	Eight years	Geography, Outdoor	Oct 17	Zoom	26/7/18
Juno	Ten years	Science	Nov 17	FaceTime	20/7/18
Bruce	Six years	Science, Biology, Sport	May 18	Skype	29/6/18

3.5.3.4 *Ethical considerations in Phase three*

In order to follow ethical considerations in the research, an information letter, consent form and the invitation to join the community were sent to the volunteers via email once they demonstrated their willingness in joining the community. It provided teachers with a brief description of the research purpose, study design, and relevant ethical considerations (see section 3.7). Participants were also informed about the right of withdrawal. This entails that the participants might be part of the Google+ Community and participate in webinars, but may not want to be interviewed or have their posts or webinar discussions analysed. The information sheet also explained that the study was concerned with teachers' perceptions and experiences of professional learning in EE through social media in general and Google+ Community in particular. They therefore were aware that their posts, activities and webinar discussions would be considered as the research data. Once the duration of the study had ended, the information letter and consent form were emailed to the participants again. However, only four teachers who actively engaged in all or some of the community activities and webinars gave their consent to be involved in the study and took part in the interviews.

3.5.3.5 *Data generation process*

Data gathering in Phase three entailed semi-structured interviews with the four participants, as well as document analysis, both before and after interviews. The first step was to invite the teachers who were engaged in the community to participate in an interview. To this end, teachers were informed that the research process had ended

through a post on the Google+ Community on 25th June 2018 (see Appendix F). It was mentioned that I was interested in interviewing both those teachers who actively engaged, and those who did not engage in the EEfS learning community. Accordingly on 26th June 2018, the interview invitation, an information letter and consent form were sent via email to eight teachers, who were members of the community. For the convenience of participants, teachers were asked to indicate their consent via email. It was explained that the interview would focus on their perceptions of teacher professional learning through social media, based on their experiences as an EEfS Google+ member. Teachers were also asked to determine the interview method, and the date and time of the interview. Four teachers who participated in all or some activities indicated their interest to be interviewed.

The next step was organising suitable interview times with each of the participants. Once teachers confirmed their interest in taking part in the interview, a reminder and confirmation email were sent to the volunteers one day before each interview. The interview date, time and method were confirmed with them via email. The first participant interview took place in June, and the second in July. This gap between interviews provided me with the opportunity and time to revise and review the questions. The interviews were carried out via Skype, Zoom and FaceTime, based on the participants' preferences. Before each interview, I reviewed the participant's posts on EEfS Google+ Community and their discussions through webinars.

3.5.3.6 Data generation methods

This section describes the different research methods employed in the third phase of the study. For this phase, document analysis alongside the interviews was used to generate data.

Document analysis

In this phase of the study, document analysis was used to determine interview questions and to triangulate findings. According to Bowen (2009, p. 30), analysing documents provides “background and context for additional questions to be asked, supplementary data, a means of tracking change and development, and verification of findings from other data sources”. Document analysis in this research project involved reviewing electronic or internet based documents (Bowen, 2009), in the form of social media posts and online

discussions through webinars. Analysing teachers' posts on the EEfS Google+ Community and video capture of the webinars provided new information that led me to design more useful interview questions before conducting interviews. It also made the process of bracketing in interviews easier (see section 3.5.2.).

I also reviewed teachers' activities after each interview. This provided the opportunity for me to find out more about the participant's activities and involvements as a member of a social media learning community. Teachers' synchronous and asynchronous activities and discussions as a member of the EEfS Google+ community were reviewed to find relevant information. This allowed me to clarify the meaning of their interviews and improve my understanding about teachers' perceptions (Merriam, 1988) and experiences as a member of the EEfS community.

Interviews

For the purpose of this phase, interviews were used as the main method to generate data. Most of the interview questions in this phase emerged from reviewing teachers' activities in the EEfS community. Since establishing the EEfS Community on Google+, I had reviewed the posts from members. A word document for each teacher's posts and discussions on webinars was created. Before each interview, the document was printed and read. Having done that, I was able to ask more prompt questions based on individual posts and conversations in webinars. These prompts enabled interviewees to continue sharing about their experiences. Therefore it was easier to direct interviews towards my research focus. With participants' permission, interviews were recorded in order to be transcribed (Punch, 2014). In line with ethical considerations, the interview transcripts were emailed to the participants to enhance the validity of the study data (Guba, 1981).

While I was aware of the key role of piloting the interview questions in relation to the study's phenomenographical approach, interview questions were not piloted before conducting interviews because of the limited number of teachers in the EEfS Community on Google+. In addition, participants' posts on the EEfS Google+, their webinar discussions and activities were used to frame the interview questions. Also, the first interview allowed me to notice some points which I then used to develop questions for later interviews. To do this, I listened to the audio recording of the first interview repeatedly in order to transcribe it. This helped me to collect information, and notice

important points in the interviewee's answers. Also as the final question, I asked the interviewee to add any suggestions and recommendations regarding TPL in EE through social media. These helped me to think about what I might gain through asking different questions in each interview. Although the main questions remained unchanged, the prompt questions were slightly different for each interviewee based on her/his involvement in the EEfS Community.

There were some more limitations in collecting data in this phase. First, there was no opportunity for face to face interviews, as the participants were living in different regions. Second, the EEfS Google+ Community was a closed group with a limited number of members. Therefore, only four secondary teachers were interviewed. In addition, as an outsider I did not feel the frustration and limitation for teachers to join a professional learning community. To overcome these limitations, careful consideration was given to capture teachers' perceptions from different data sources.

3.5.3.7 *Data analysis*

Like in previous phases, thematic analysis was used in this phase of study to find the themes within data. As described earlier, thematic analysis in this study involved organizing and describing the data. To this end, my focus was to find important elements of the way in which teachers described their perceptions and experiences as members of the EEfS Google+ Community. Thematic analysis enabled me to identify implicit and explicit ideas within teachers' interviews on the topics. Data were categorised with respect to the teachers' perceptions of their learning through the EEfS Community. To this end, teachers' answers to the interview questions were considered the main data source and formed the basis of the research findings. Data from interviews were supplemented by data gained from analysing teachers' participation, activities and engagements as the EEfS Google+ Community members. An overview of Phase three is shown in Figure 3.2.

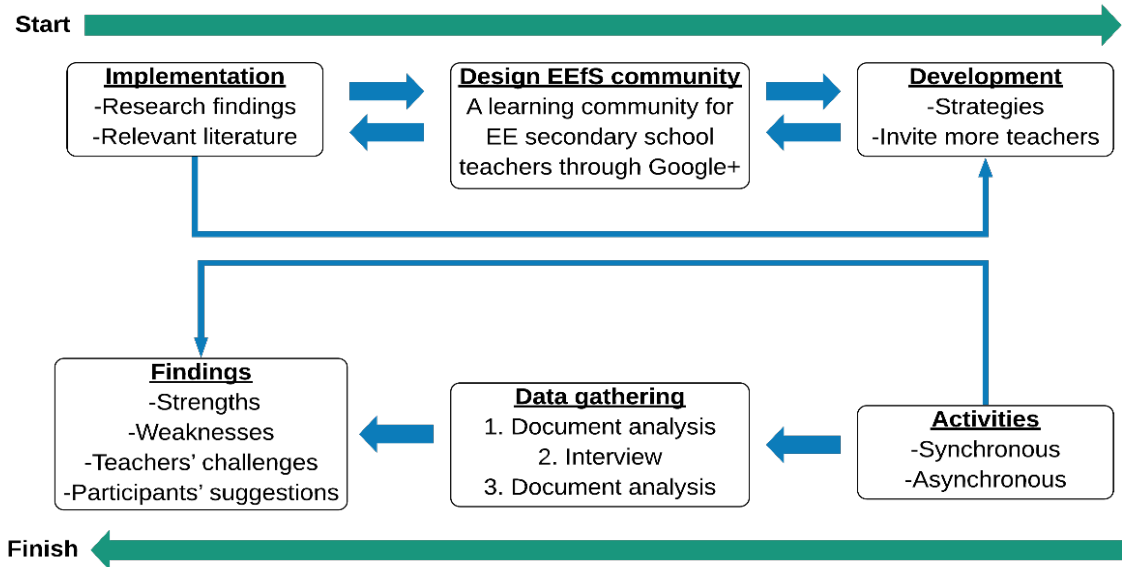


Figure 3.2 Phase three procedure

3.6 Trustworthiness

Trustworthiness in research refers to research quality, which is defined variously in relation to diverse research paradigms and methodologies (Cohen et al., 2011; Shenton, 2004). The value of a piece of qualitative research depends on its trustworthiness, which involves credibility, transferability, dependability and confirmability (Shenton, 2004). Guba (1981) considered these four trustworthiness factors in qualitative research as an alternative to validity and reliability in quantitative studies. Credibility refers to internal validity; transferability has to do with external validity; dependability means reliability, and confirmability is comparable to objectivity. To increase the trustworthiness of this study and confidence in its findings, a mixed method approach, involving several data collection instruments and data analysis methods, was used to allow for triangulation (Shenton, 2004). With reference to Section 3.5.1.1 (Phase one), quantitative aspects included in part of the questionnaire were subject to validity and reliability checks, through content validation and piloting. For qualitative data, triangulation, member check and peer debriefing were employed, where appropriate, to improve the quality of the research. Also, using a phenomenographical approach, bracketing strategy (see section 3.5.2.2) was used to avoid bias caused by the researcher's motivation or interests in order to increase the research confirmability (Lincoln & Guba, 1985). Interview questions were piloted where practicable before conducting interviews and data were reported in depth.

3.6.1 *The research credibility*

Since credibility refers to demonstrating the ‘truth’ of the research study findings, it is seen as the most important condition in establishing trustworthiness. Credibility in qualitative research involves establishing credible findings. Therefore, to address research quality, credibility in findings is vital. The requirement of credibility in this research was met by a number of techniques, including triangulation, peer debriefing and member checks (Lincoln & Guba, 1985).

3.6.1.1 *Triangulation*

Triangulation is a recommended technique in qualitative research for gaining an holistic, better understanding of the phenomenon being studied. Triangulation involved using different methods at different phases of this study, from initial framing and applying theories, to data gathering methods and data analysis. Triangulation can therefore be achieved by using both qualitative and quantitative data collection methods, such as questionnaires and interviews.

In this study, I employed method triangulation, which involved the use of several methods, including a questionnaire, interviews, and document analysis for gathering data (Lincoln & Guba, 1985). Data obtained from the questionnaire provided me with background information to explain teachers’ perceptions regarding the use of social media. Later, findings from Phases one and two were supplemented by document analysis in Phase three.

According to Shenton (2004), to achieve triangulation, data sources using a wide range of informants can help. To meet this requirement, the questionnaire was designed to capture a range of data from teachers. Participants were also asked to answer various questions regarding TPL in general, TPL through social media, and also their general and personal use of social media. By asking a wide range of questions, even those teachers who were not interested in using social media were able to contribute to the study. Based on the contributions of a range of teachers, their viewpoints and experiences were verified to provide an holistic picture of the teachers’ perceptions of professional learning through social media. The research benefited by drawing informants from among teachers who were against the use of social media as well as those who favoured the idea of using social media in TPL. In addition, to allow triangulation in this study, the sampling in Phase one

included a range of teachers in various educational settings, from early childhood to secondary school.

3.6.1.2 *Peer debriefing*

To establish the trustworthiness of the findings, peer debriefing supports the credibility of the data by minimizing bias in qualitative research (Lincoln & Guba, 1985). In debriefing, through extensive discussion, a researcher has to convince her/his peers about the research methods, data collection, data analysis and the research findings. To achieve credibility, from the initial framing to report writing, this research was supervised by two experts. Both my supervisors are knowledgeable about qualitative research methods. One is an expert in EE and one in TPL through social media. Debriefings were therefore carried out through ongoing supervisory meetings and regular conversations with my supervisors.

3.6.1.3 *Member checks*

According to Lincoln and Guba (1985), member checks are the most important strategy for achieving the credibility of the findings. These checks ensure the accuracy of the data and improve research quality. This strategy was used in this research to meet the requirement of credibility, and the research participants were asked to read the transcripts of our conversations. To this end, the interview transcripts were sent to the participants for verification. A transcript of each interview with the teacher was sent by email to check the accuracy of my record of the participant's views. They were asked to add, delete or comment on the content. As I intended to use interview data in direct quotes, the emphasis was also on wording. Participants were therefore asked to confirm whether the transcript matched their words. In line with the methodical approach used in this study, participants were also asked to check the content to ensure it conveyed what they intended to say. Since audio recording was used during interviews, the accuracy of captured interviews and transcripts was confirmed by the research participants (Shenton, 2004).

3.6.2 *Transferability*

In qualitative research, transferability can be established by providing readers with evidence from findings. However, as Lincoln and Guba (1985) argue, it is the reader's responsibility to decide whether or not a study is transferable and instructive for their own

research. The researcher, on the other hand, is responsible “to provide the database that makes transferability judgements possible on the part of potential appliers” (Lincoln & Guba, 1985, p. 136).

Following Lincoln and Guba’s (1985) recommendations, I have used a “thick descriptive data” strategy and have provided a comprehensive description of the research process. Specifically, a robust, detailed explanation of the data gathering process and methods has been supplied, providing a good understanding of the research setting, which in turn will help readers form a judgment about transferability.

3.6.3 *Dependability*

Dependability describes the quality of being reliable and implies the replicability of a study. Lincoln and Guba (1985) state that to achieve dependability in a study, data must be accurate and consistent. Data stability helps researchers obtain consistent results at a different time and under different conditions. Since auditing facilitates evaluating the dependability of data, and in accordance with Lincoln and Guba (1985) recommendations, I adopted an audit trail and documented the research process. Data, including questionnaires, interview recordings and transcriptions, and supporting documents, such as consent forms, were organised, saved and stored in my personal computer. This measure allowed me to review the data where necessary.

Having taken these steps, I was able to provide a comprehensive description of the research process and procedures by describing the study phases in detail. The research process, including selection of participants, data gathering methods, data analysis, and interpretation, was described clearly for each phase of the study. An overview of the research design, its implementation, strategies, and plans for conducting the research in Phase 3, was also provided (Schwandt, Lincoln, & Guba, 2007). The study therefore supplies necessary information for other researchers to repeat the research in different situations.

Dependability is also closely linked with credibility. As highlighted earlier, such techniques as triangulation and peer debriefing were used in this study, improving its dependability (Lincoln & Guba, 1985; Schwandt et al., 2007).

3.6.4 *Confirmability*

To establish confirmability in qualitative research, the researcher must provide a foundation for the reader's confidence that the research findings are based on the participants' views, rather than the researcher's interests, beliefs, preferences, and judgements. In order to establish the confirmability of the research, triangulation was used to reduce the effect of researcher bias. I also explain the reasons for my decisions in the research process. Techniques, such as an audit trail, were used to report the reasons for decisions made and steps taken in this research (Shenton, 2004). Moreover, phenomenography was adopted to reduce the effect of my own predispositions. As part of this approach, bracketing strategy was employed at different stages of the study, from data gathering to reporting findings (Lincoln & Guba, 1985). Interview questions were piloted before conducting interviews and data were reported in depth.

3.7 *Ethical considerations*

Ethical considerations in this research involved avoiding harm to participants emotionally and physically, ensuring informed consent, assuring privacy for participants in the research process, and addressing issues of confidentiality in relation to the data collected (Lune & Berg, 2016). The study's ethical issues were considered at all stages, and ethical approval was granted by the University of Waikato Human Research Ethics Committee with regulations and guidelines to be followed in every step of the research (see Appendix G).

3.7.1 *Avoiding harm to participants*

Potential harm tended to be low in this study. However, there was a possibility that teachers may feel embarrassed about their social media activities. To help reduce this, the participants were advised via the consent form, of their right to decline to answer any of the questions, and that they could withdraw at any point of the study up until analysis commenced. For example, it was mentioned that a participant can withdraw from the survey by not submitting it, ask for their interview data to be withdrawn, or ask to be withdrawn from being observed or having their social media posts analysed before the data analysis stage if the data from each participant is recognizable. Also, participants were informed that they could withdraw during Phases two and three at any time up to two weeks after receiving the transcript of their interview, or at any time before their posts

began to be analysed. It was also acknowledged that participants were investing their time in participating, and I was careful to limit this to 30 minutes for the questionnaire and interviews, which was notified to participants. Any cultural and social issues were considered as well, and I have sought advice from my supervisors in every step of the research. As my cultural background differed from the participants, I also considered possible cultural sensitivity issues in this research. In this regard I was assisted by a Māori mentor and my supervisors, who were members of the learning community in Phase three.

3.7.2 Informed consent

The participants were fully informed of ethical concerns such as privacy, anonymity and withdrawal rights pertaining to this research via an information sheet (Johnson & Christensen, 2008). Information and instructions were included with the online questionnaire which was implemented in the first phase of the research (see Appendix A). The questionnaire's introduction therefore furnished participants with information on what the research involved; how the research findings would be used; how I would be protecting participants' anonymity and using data only for the purposes of this research. Therefore, participants were fully aware of their rights in the research process and procedures; their voluntary contribution to the research; potential threats and benefits; and ethical concerns (Cohen et al, 2007), especially related to research through an online environment, before giving their agreement to be a volunteer participant in this study.

In order to remind participants of their rights in this research, an information sheet was also presented to teachers who agreed to be interviewed in Phase two (see Appendix H), and teachers who participated in the learning community through Google+ in Phase three (see Appendix I). In Phase three, participants were also advised that they could be part of the learning community without considering their posts as data, if they chose not to give consent for their posts to be used as data. Having done that, each participant's consent therefore was obtained in each phase prior to data collection.

3.7.3 Privacy and confidentiality

Participants' privacy was of significant concern in this research. Therefore, in order to respect and protect their privacy (Lincoln & Guba, 2003), participants were asked to suggest an interview method, date and time for their interview with which they felt comfortable. The date, time, and interview method therefore were confirmed by the

volunteers before interviews (Cohen et al., 2011). Furthermore, using a recording device for interviews and recording online communications between participants, or participants and researcher, was agreed to by participants through informed consent.

To assure confidentiality in this study, the main concern was that the research data would not reveal a respondent's identity (Johnson & Christensen, 2012). To this end, data mostly was reported in aggregated form. In Phase one participation in the survey was anonymous, and I have used numbers for referring to teachers while using direct quotes from them. Those participants who were engaged in Phases two and three were asked to provide contact details separately to their survey responses. Data from interviews and document analysis in Phases two and three are reported using pseudonyms, and any traces of respondents' identities have been removed from the data. Direct quotes from interviews were used only once participants had the opportunity to verify and approve their transcripts. However, it is recognised that anonymity cannot be guaranteed in research (Cohen et al., 2011), especially for data from social media posts that may have been visible to other parties who had access to the posts. To avoid this concern, a closed community on Google+ was used in the third phase of the study. In this study, however, while participants were aware of the potential risks, they provided their consent to be part of the study.

3.8 Chapter summary

This chapter has outlined the research methodology and methods including the research paradigms, methodology, methods, and research approach. The research design, its processes and procedures were also described.

The philosophical view informing this research is that people and social groups construct multiple realities in relation to different aspects of the world. Therefore, questioning EE teachers' perceptions and experiences regarding the use of social media in their professional learning in EE helped me find out about the multiple realities of TPL through social media in EE. Toward this end, second order perspectives from questionnaires and interviews were used to have a clear understanding about this topic.

As mentioned, the study design in each phase informed the next phase. An online questionnaire including both open and closed questions was administered to Enviroschools' lead teachers all around New Zealand. Then, five teachers were

interviewed in order to explore social media usage among EE teachers for their professional learning through clarifying the emerging findings from Phase one.

For the third phase, I firstly concentrated on implementing findings from the two previous phases in order to set up a network for TPL in EE. Secondly, my key tasks were reviewing findings, setting up a community for learning based on the findings, and administering the learning community, such as running webinars. In the last step of Phase three, I interviewed research participants to understand their experiences as a member of a learning community and to deepen my understanding of teachers' perceptions and experiences of professional learning in EE through social media. Teachers' posts on the EEfS Google+ Community and their discussions in webinars were reviewed twice, once prior to conducting each interview and once after interviews. Although document analysis was involved, teachers' answers to the interview questions were the basis of the research findings in Phase three.

This chapter also described different criteria to enhance trustworthiness in the research and improve the research quality. Strategies to consider ethical issues in all stages of this research were described in the last section.

The next chapter is the first findings chapter of this study which mostly presents and summarises findings from quantitative data which emerged from the questionnaire in Phase one.

Chapter Four:

The participants' background information

This chapter presents findings drawn from the questionnaire and interviews in Phase one and Phase two. The primary purpose of Phase one was to provide background information from EE teachers. Therefore, the focus of this chapter is the description of participants' characteristics such as demographic characteristics, social media usage patterns, and their perceptions of environmental education (EE) as well as teacher professional learning (TPL) in EE. Findings in this chapter are also used to address the first and second research sub-questions regarding the use of social media amongst New Zealand teachers who are engaged in EE and teachers' perceptions and experiences of professional learning in EE. The first section of this chapter, therefore, encompasses demographic information of respondents, followed by the participants' social media usage patterns, and teachers' perceptions of EE. Then findings on teachers' perceptions of professional learning, professional learning in EE and collaboration for TPL in EE are presented. The chapter concludes with a summary of these findings.

4.1 Demographic characteristics and background information of participants

This section presents the demographic characteristics and teaching background of the participants. These characteristics include gender and age (Table 4.1), followed by educational setting (Table 4.2), teaching experiences and years in teaching EE (Figure 4.1). Graphs and tables, in this section, depict the descriptive statistics of demographic characteristics and teaching background of the respondents.

4.1.1 Distribution of the respondents by gender and age

As Table 4.1 indicates, the distribution of the respondents regarding gender was not equal. Out of 175 participants who responded to the questions asking about their gender, 90% (157) were female and 10% (18) male. This gender distribution is in line with the data reported on 2017 teaching staff by the Ministry of Education (Ministry of Education, 2018). 176 participants responded to the question asking about their age. The variance in the ages of the participants indicated that the majority of respondents were older than 40 (77%), while 45% of the respondents indicated that they were more than 50 years old.

Only 4% (7) of survey respondents were younger than 30 years, and 19% (34) were 30-39. In summary, participants were mainly female and older than 40 years of age.

Table 4.1
Demographic characteristics of respondents

Gender (n=175)	Frequency	Percentage
Female	157	90
Male	18	10
Age (n=176)		
20-29	7	4
30-39	34	19
40-49	57	32
50-59	54	31
60 and above	24	14

4.1.2 *Distribution of the respondents by educational setting*

Table 4.2 presents the distribution of respondents by the education setting where they currently work. The table shows the distribution of respondents in different educational settings was not equal. Primary school teachers with 52% (92/176) respondents were the largest group of participants. Early childhood teachers were the second largest group with 31% (54) followed by secondary school teachers with 8.5% (15) of participants. In addition, 5% (9) of the participants stated that they were intermediate school teachers, while only 3% (5) from composite schools and only 0.5% (1) from special schools participated in this study. The number of participants from different educational settings is somewhat in alignment with the proportion of educational settings which are participating in the Enviroschools programme, indicating a fair representation of the population that was surveyed (Enviroschools, 2015, 2016). In summary, the respondents were mainly from primary and early childhood settings.

Table 4.2

Descriptive statistics of respondents' educational setting

Educational setting	Frequency	Percentage
Early childhood centre	54	31
Primary school	92	52
Intermediate school	9	5
Secondary school	15	8.5
Composite/area school	5	3
Special school	1	0.5

4.1.3 Distribution of the respondents by years of teaching and years of their involvement in environmental education

Figure 4.1 presents the distribution of respondents by the number of years in which they have worked as a teacher, and the number of years in which they have been working as an EE teacher. The majority of the respondents, 77% (132/173), had been teaching for more than ten years; 16% (28) of the respondents have been working between five to nine years; and only 7% (13) have less than five years' teaching experience. As Figure 4.1 illustrates, the respondents varied in time of being involved in teaching EE. These findings indicate 35% (61/174) of the teachers had been engaged in EE for less than five years, and 33% (58) of participants had been involved in EE for five to nine years. The findings also indicate that 24% (41) of participants had been engaged in teaching EE for 10-19 years, and 8% (14) of participants teaching EE for more than two decades. While EE is an interdisciplinary approach in the New Zealand education system, teachers' involvement in teaching EE is somewhat in line with the development of the Enviroschool programme. As mentioned in Chapter 2, the Enviroschool programme commenced in the 1990's and since then has grown gradually. Since 1993 the number of Enviroschools has increased nationally, which has involved more teachers. In summary, while the majority of respondents had more than ten years' teaching experience, they had generally been teaching EE less than ten years.

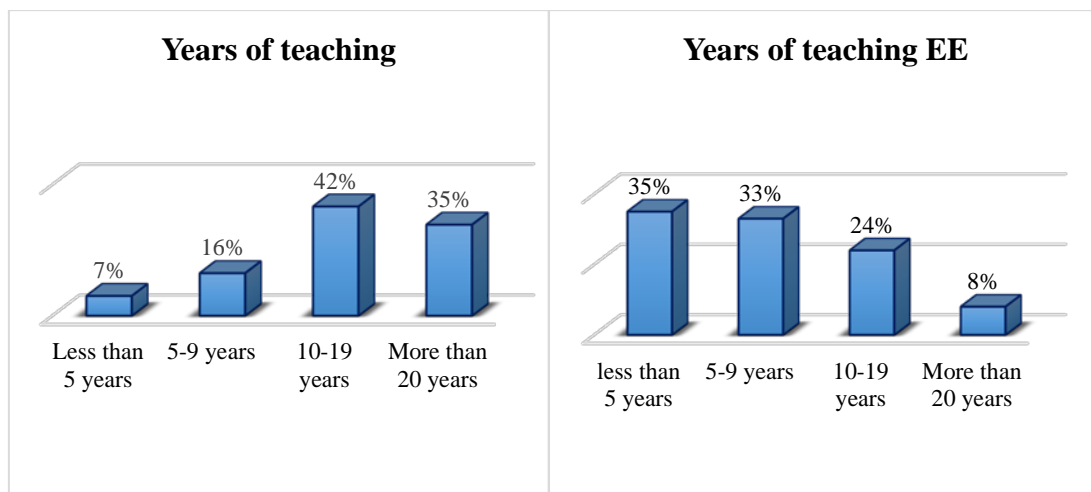


Figure 4.1 Respondents' years of teaching and years of teaching EE ***Teachers' confidence to teach environmental education***

In order to explore EE teachers' confidence to teach EE, respondents were asked to select from a scale of one to five to indicate how confident they felt. Categories ranged from not confident at all (1) to very confident (5). As shown in Figure 4.2, the findings that emerged from this question signified that the highest proportion of respondents, 52% (91/175), confirmed that they were moderately confident, followed by 30% (53/175) of participants who feel very confident. Overall, most EE teachers (over 80%) considered themselves confident to teach EE on some level.

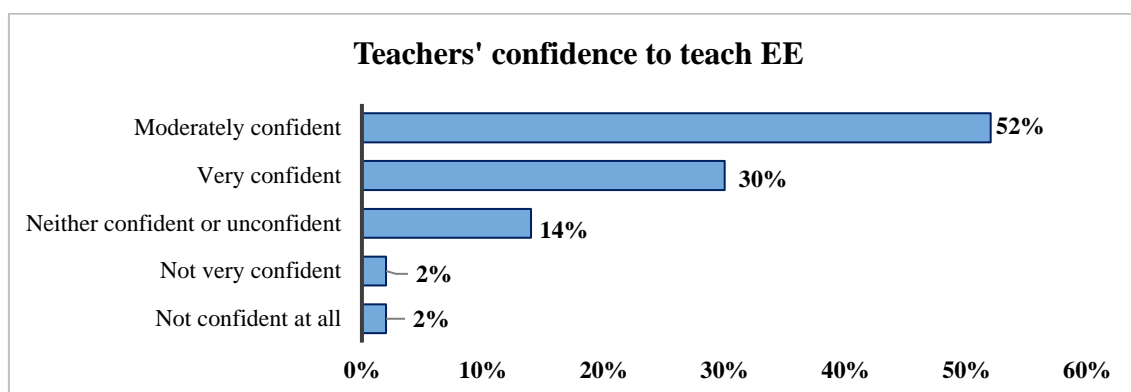


Figure 4.2 Descriptive statistics of EE teachers confident to teach EE

4.1.5 Demographic summary

In summary, the majority of respondents were female over 40 years who were working in primary schools or early childhood centres. While most participants had more than a

decade of experience in teaching, their involvement in EE was generally less than ten years. The findings also show that teachers mostly felt confident to teach EE.

4.2 The participants' social media usage patterns

The questionnaire contained several questions designed to generate data regarding EE teachers' social media usage patterns and their perceptions and experiences of using social media. The research aimed to understand how teachers perceived and experienced social media for their professional learning in EE. Therefore, the research participants were asked to report their favourite platforms for social media use and the frequency of their social media activities, including any general professional learning and professional learning in EE. This section indicates findings from analysing data regarding social media usage among EE teachers.

4.2.1 Devices and places to engage with social media

Participants were asked to indicate which devices they used to engage with social media and the places where they connected to social media. As Table 4.3 shows, laptop computers were teachers' most preferred device to engage with social media, whether at work or outside the workplace. Laptop use was indicated by 63% (109/172) of participants. Mobile phone outside work was chosen by 44% (76) of participants followed by mobile phone at/outside of work by 39% (67) of participants. Only 1% (2 teachers) of participants reported that they use mobile phone only at work to engage with social media. Twenty-eight percent (49) of the teachers used tablets/IPads while they were at/outside of work. Overall, as Table 4.3 shows, in contrast to desktop computers, which were mostly used at work to engage with social media, mobile phone is teachers' preferred devices while they are not at work.

Table 4.3

Descriptive statistics of the type of device and place that teachers engage with social media

Device	At work		Outside of work		At/outside of work	
	N	%	N	%	N	%
Laptop computer	27	16%	25	15%	109	63%
Mobile phone	2	1%	76	44%	67	39%
Tablet/IPad	24	14%	33	19%	49	28%
Desktop computer	25	15%	16	9%	16	9%

4.2.2 Teachers' preferred social media platforms for different purposes

The questionnaire asked teachers to identify the social media platform(s) that they use for different purposes in order to explore social media usage patterns among EE teachers. In response to this question, teachers recognised different platforms for use for any purpose, for learning in general, professional learning in general, and professional learning in EE. As Figure 4.3 illustrates, teachers' favourite platforms for any purpose were Facebook (69%), followed by Google+ (40%) and YouTube (39%).

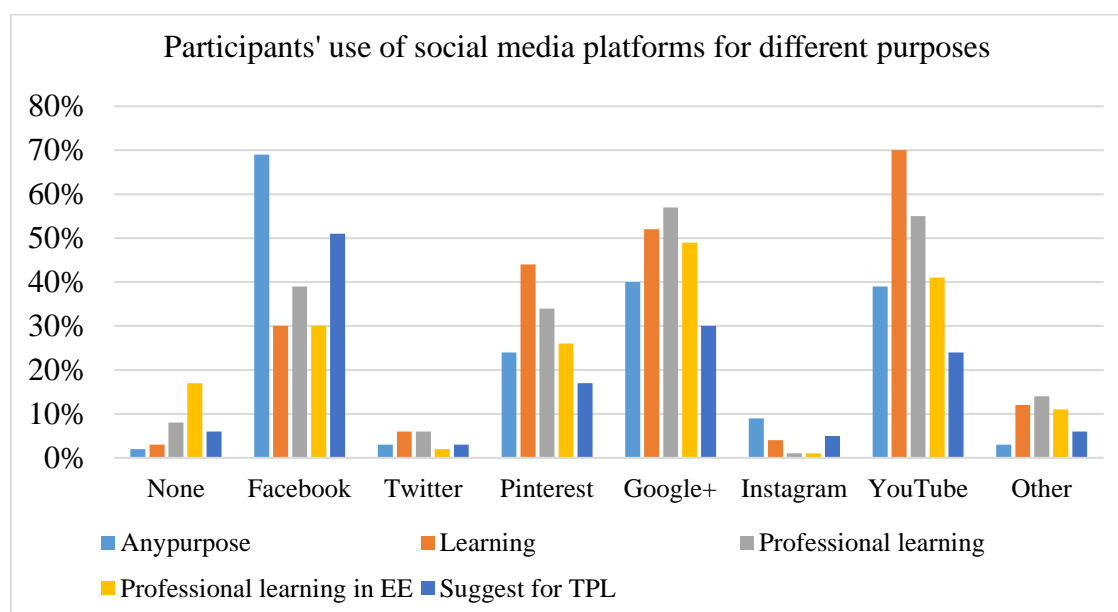


Figure 4.3 Social media usage patterns among EE teachers

While 69% (121/176) of participants confirmed that they used Facebook the most for any purposes, the percentage of Facebook users dropped to 30% (52) when it comes to learning, 39% (69) for professional learning in general and 30% (53) for professional learning in EE. Nevertheless, Facebook was recommended by half of the participants (51%) as their suggested platform for TPL in EE. This may be due to Facebook's ease of use and popularity (Sibona & Choi, 2012). In addition, most teachers may feel more comfortable using Facebook because of its familiarity. Therefore, they may have built their professional network on Facebook, while they may be not so familiar with some of the newer social media platforms, as highlighted in one of the interviews. In the words of a teacher when she was asked her reasons for using Facebook for professional learning:

I think because I do not have enough information about using other social media for learning. On the other hand, maybe, because of what I am teaching and I can find related information or other teachers on Facebook. Twitter, for example, takes too much time to find and remember things, but Facebook is much easier and faster. However, if I am convinced of the value of any sort of social media, I would invest my time to learn about it and use it for my learning. (Helen, interview 1)

As Figure 4.3 illustrates, while the majority of participants, 70% (123/176), indicated that they use YouTube for learning in general, the number who used YouTube for professional learning was less at 55% (97), and even less 41% (72) of the teachers, reported using YouTube for professional learning in EE. Many teachers therefore indicated that they used YouTube for learning and professional learning. However, as one of the interviews highlighted, teachers do not recognise YouTube as social media because their use is confined to viewing rather than to production and sharing of content (Geoff, interview).

As Figure 4.3 signifies, 40% (71/176) of teachers used Google+ for any purposes, 52% (92) for learning, 57% (101) for professional learning in general and 49% (87) for professional learning in EE. As the Figure shows, the use of Google+ for professional learning in general and professional learning in EE was higher than for other platforms. Also, the use of Google+ among teachers for different purposes was higher than Twitter, Pinterest and Instagram.

The questionnaire also probed the use of Pinterest among EE teachers. Pinterest was reported as being used as a learning platform by 44 % (77/176) of participants, by 34% (60) for professional learning in general and 26% (46) for professional learning in EE.

While the research did not find any correlation between teachers' age and using social media in general and Pinterest in particular, in her interview Karen mentioned that young teachers in her school, "use Pinterest to get ideas for gardens and some development around the school".

Teachers were also asked to indicate their Twitter usage. As shown in Figure 4.3, compared to other social media platforms, Twitter was not popular among the research participants as it used by 3% (5/176) of participants for any purposes, 6% (11) for learning in general, 6% (10) for professional learning in general and 2% (4) of participants for professional learning in EE. Similarly, Instagram was not a popular platform as it was being used by 9% (16/176) of participants in general for any purposes, 4% (7) for learning, 1% (2) for professional learning in general and 1% (2) professional learning in EE.

The study was further interested in exploring what teachers might suggest as a social media platform for TPL in EE. To this end, as part of question 8, participants were asked to identify social media platforms which they suggest would be useful for TPL in EE. As Figure 4.4 indicates, Facebook was chosen by the highest number of participants at 51% (89/176) followed by Google+ at 30% (52), YouTube at 24% (43) and Pinterest at 17% (30).

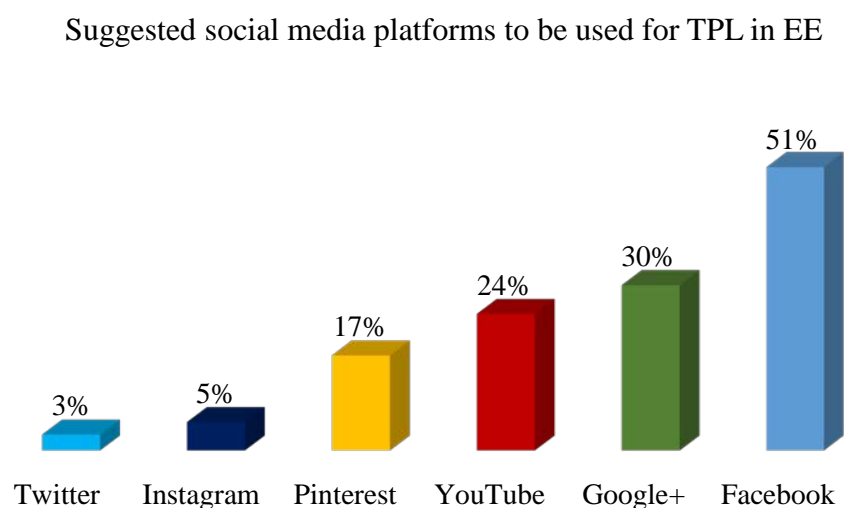


Figure 4.4 Suggested social media platforms to be use for TPL in EE

Teachers also were asked to report if they use any other social media platforms for the aforementioned purposes. In this regard, participants indicated a wide range of social media platforms such as blogs, Edmodo, Snapchat, Messenger, LinkedIn, POND and VLN. The EnviroSchools website was seen as another learning channel by teachers (but would not be considered a social media in this study). A few teachers indicated that they consider TED talks as one of the effective digital ways of professional learning. Although a TED talk could be used by teachers for their professional learning, it is not collaborative. Therefore, learning through listening to a TED talk is beyond the scope of this study. A teacher mentioned that she used a combination of a number of social media platforms at the same time (T143). Another teacher claimed specific websites for specific learning would work well (T150).

To recap, most respondents were Facebook users (69%). YouTube was the most popular platform among participants for learning in general (70%). Google+ was seen as a popular social media platform for professional learning in general (57%) as well as professional learning in EE in particular (49%). The use of Google+ for professional learning and professional learning in EE therefore was higher than other platforms. In addition, its use for different purposes among participants was higher than Twitter, Pinterest and Instagram. Also, Pinterest was reported being used more than Twitter and Instagram by participants. As the data indicated, compared to other social media platforms, Twitter and Instagram had the least usage among participants. Facebook seems to be teachers' preferred platform for professional learning in EE, although many teachers also report using YouTube and Google + for learning.

4.2.3 Frequency of teachers' activities through social media

Participants were also asked to indicate the frequency of their activities, including professional learning in general and professional learning in EE on social media, most participants 68% (120/175) identified that they consider personal use of social media often or very often to keep in touch with friends and family, as can be seen in Figure 4.5.

The frequency of using social media for networking with colleagues among participants was less than its use for interaction with family and friends among participants. Among the teachers, 37% (62) often or very often use social media for networking with colleagues, while 36% (61) only sometimes use social media for networking with their

colleagues. In his interview, Geoff suggested one reason for restricting his use of social media to friends and family:

I use Facebook to keep in touch with my family and friends and keep contact with those people who are not living around me. I do not have my boss on my Facebook because I see her every day at work. But I have my family, relatives and friends who are not living around me.

As findings show, 53% (91) of the participants indicated that they learn through social media either often or very often. The percentage of teachers who often or very often use social media for professional leaning was 46% (79) and for professional learning in EE was 29% (51).

However, the data show that social media were utilised in teachers' learning as well. Only 4% of respondents (7 individuals out of 175), indicated that they never use social media for learning, and 5% (8/175) had never used social media for professional learning. Despite the wide use of social media for learning in general, it was less utilised for professional learning in EE, as only 6% (10/175) participants reported that they very often used social media for professional learning in EE purposes.

In summary, the findings of the questionnaire indicated (see Figure 4.5) that social media are mostly used for social interactions with family and friends. Among teachers, networking with colleagues through social media was less popular than social interactions with family and friends. Teachers were also aware of educational use of social media and utilized it for learning and professional learning. Figure 4.5 presents the frequency of teachers' activities through social media.

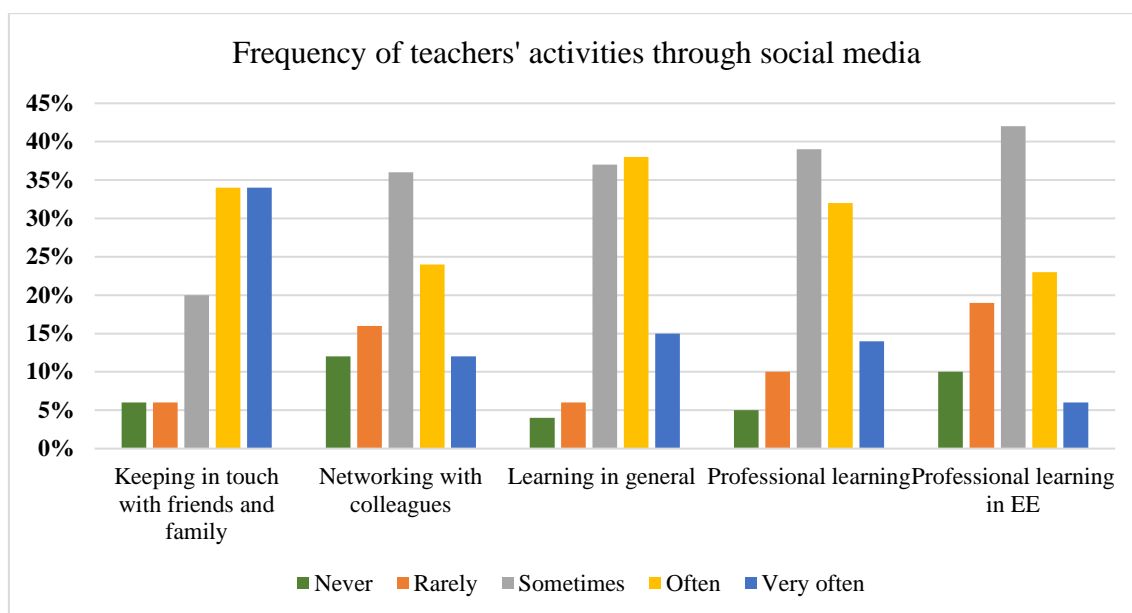


Figure 4.5 Frequency of participants' activities on social media

4.2.4 Summary of participants' social media usage patterns

In summary, the data regarding participants' social media usage patterns suggest that social media are widely used by teachers for a variety of purposes, including regular use for learning. In order to engage with social media, teachers generally use a laptop computer (63%) at/outside the work and mobile phone outside the work (44%). Desktop computers are mostly used at work (44%) whereas mobile phones are used when they are not at work (46%).

The majority of participants claimed that they engaged with social media in general, and with YouTube in particular, for learning purposes. Most respondents were Facebook users for any purposes (69%). YouTube was the most popular platform for learning in general (70%) and Google+ for professional learning (57%) as well as professional learning in EE (49%). Although many teachers use YouTube and Google+ for learning and professional learning, Facebook seems to be teachers' preferred platform for professional learning in EE as it was suggested by 51% of participants.

The frequency of using social media among participants shows that social media were more used for social interactions with family and friends than networking with colleagues and learning. However, the research findings showed that teachers were aware of educational use of social media as social media were employed for learning and professional learning among participants.

4.3 Teachers' perceptions of teaching and learning in environmental education

The *Guidelines for Environmental Education in New Zealand Schools* promotes the exploration of sustainability through the school curriculum (Ministry of Education, 1999). Through EE teaching and learning, teachers can support students to be active learners who can contribute to sustainability. A question, therefore, was posed to explore teachers' views regarding the role of EE and EE teachers in achieving sustainability in accordance with the *Guidelines*. In this regard, participants were asked to indicate their level of agreement with four statements regarding teaching and learning about environmental and sustainability issues. Participants were asked to respond on a scale where strongly disagree was scored as 1, disagree as 2, neutral as 3, agree as 4 and strongly agree as 5. As shown in Table 4.4, teachers' responses indicated that the majority of participants agreed with all four items. The low standard deviation and the high mean score of the responses indicate teachers' positive views regarding sustainability through the school curriculum. In addition, there was consistency in their responses to the four statements regarding EE teaching and learning, particularly to the first three listed in the table.

Table 4.4
Teachers' views about teaching EE and sustainability

Statements	Mean	Std. D
To engage students in EE, I believe teachers need to know how to facilitate student decision making and taking action towards sustainability	4.55	0.55
To facilitate EE, I believe teachers need to be able to explore values associated with environmental and sustainability issues with their students	4.54	0.57
To deliver EE, I believe teachers need to develop knowledge of environmental and sustainability issues	4.48	0.56
To achieve sustainability, it is important that all students engage with sustainability issues	4.28	0.75

EE was therefore seen by participants to be an important aspect of education toward sustainability as it equips students in terms of knowledge, value and skills. Teachers' perspectives regarding EE teaching and learning reflected in the questionnaire were

supported by the interviews. All five interviewees claimed that they believe EE is very important aspect of education. A teacher from a primary school said:

Our children need to be aware of social and environmental issues. These are their issues in future. So, they need to learn and be aware of it. Also, they need to know about the process of some environmental activities such as recycling or growing vegetables. EE is a way to make them aware of the choices that they could make (Karen, interview 1).

Another teacher from a secondary school said:

At the moment environment or sustainability is at the forefront of conversations. It is in the media, whether it is about fresh water or climate change. So it is important that our students understand why those issues are important and start thinking of ways to solve them. We do not have an understanding of sustainability yet, and this can be problematic in our future (Blake, interview1).

As highlighted in the quote above, some participants acknowledged a lack of emphasis about EE in schools. Helen asserted in her interview that: “I think environmental education is one of the most important things that we do, or well it should be. I don’t think that it’s really reflected around New Zealand” (Helen, interview1).

In summary, findings that emerged from the questionnaire and interviews indicated that teachers perceived EE as an important part of education. Environmental education would improve students' knowledge of the environment and its associated issues. This would enable them to take action toward sustainability by enhancing their values and skills related to the environment. To this end, the role of teachers is essential in order to empower students and equip them in terms of knowledge, value and skills to take action toward sustainability.

To gain a better understanding of teachers’ roles and characteristics of TPL in EE, participants were asked to answer some questions in this regard. Findings from qualitative and quantitative data that relate to teachers’ perceptions regarding TPL in EE methods and characteristics are presented in the following section. Then, participants’ perceptions and experiences of available professional learning opportunities in EE are discussed.

4.4 Teachers' perceptions and experiences of professional learning in environmental education

Since this study focuses on TPL in EE, participants were asked first to indicate their views regarding TPL in EE methods based on their experiences. Then, they were asked to identify their preferred TPL methods in EE. As part of interviews participants, shared their view regarding collaborative learning in EE. These findings are presented in this section.

4.4.1 Participants' perceptions of teacher professional learning methods

In the questionnaire, participants were asked to rate a number of professional learning methods, based on their experience which they found effective in improving their knowledge and skills in EE. Participants' answers were defined as an ordinal variable with the following possible responses: not applicable, *zero*, ineffective, *one*, somewhat effective, *two*, and very effective, *three*. The category not applicable was included to allow teachers who had not had one or any of the aforementioned professional learning experiences to answer this question.

As Table 4.5 shows, of the 161 teachers who answered this question, the number of teachers who reported experiencing particular teacher professional learning methods varied from 69 (formal study towards a qualification) to 151 (self-learning). As shown, the majority of participants confirmed that they have experienced a form of *self-learning* (151), *informal face-to-face discussions with colleagues* (150), *formal face to face courses* (142), *asking questions of environmental education experts in any setting* (142) and *visiting other schools to see what they are doing in EE* (140). The number dropped to 99 when it comes to *participation in a network of EE colleagues through social media* and 69 teachers for *formal study towards a qualification such as a degree programme*.

Table 4.5

Teachers' perceptions of effective TPL methods in improving teachers' knowledge and skills in EE

Teacher professional learning methods	n	Mean	SD
Visiting other schools to see what they are doing in EE	140	2.69	0.47
Field trips	131	2.66	0.52
Formal face to face courses, workshops/hui	142	2.64	0.55
Informal face to face discussions with colleagues	150	2.58	0.5
Asking questions of environmental education experts in any setting	142	2.56	0.52
Observation of other teachers' practices	137	2.45	0.55
Staff meetings or teacher only days	135	2.34	0.63
Education conferences	117	2.33	0.62
Formal study towards a qualification (e.g. a degree programme)	69	2.28	0.64
Participation in a network of EE colleagues through social media	99	2.18	0.5
Learning by yourself (any form of self-learning)	151	2.11	0.52

The table also reveals the effectiveness of TPL methods by assessing mean and standard deviation of participants' answers to this question. As shown in Table 4.4, the item *visiting other schools* to see what they are doing in EE, with 2.69, had the highest perceived effectiveness for the participants while self-learning, with 2.11, had the lowest. As indicated in the Table, among the methods listed in question 10, visiting other schools to see what they are doing in EE, field trips, formal face to face courses such as workshops, informal face to face discussions with colleagues, asking questions of EE experts in any setting had a high effectiveness. The findings also indicate that while a large number (150) of participants had experienced informal face-to-face discussions with colleagues, only 99 teachers participated in a network of EE colleagues through social media for learning.

In order to explore teachers' perceptions on professional learning methods in EE, teachers were also asked to rank their top four preferred methods, by assigning number 1 to the most preferred method, number 2 to the second, number 3 for the next, and number 4 to the fourth preferred method. The findings (Table 4.6) showed that teachers generally prefer *asking questions and discussion with EE experts in any setting*. *Visiting other schools in order to see what they are doing in EE* was chosen as the second most preferred method, followed by *formal face to face courses, workshops/hui* as the third, and *field trips* as the fourth most preferred TPL methods in EE.

Table 4.6
Participants' preferred teacher professional learning methods in EE

Teacher professional learning methods	Rank
Asking questions and discussion with environmental education experts	1.95
Visiting other schools to see what they are doing in EE	2.15
Formal face to face courses, workshops/ hui	2.16
Field trips	2.36
Participation in a network of teachers through social media	2.47
Informal face to face discussions with colleagues	2.66
Observation of other teachers' practices	2.68
Formal study towards a qualification (e.g. a degree programme)	2.7
Education conferences	2.71
Staff meetings or teacher only days	2.76
Learning by yourself (any form of self-learning)	2.81

4.4.2 Teachers' perceptions of effective teacher professional learning characteristics

To explore different aspects of TPL in EE, research participants were asked to rate the importance of some TPL features in improving teachers' skills and knowledge in EE (from very low, 1, to very high, 5). Table 4.7 presents the results of analysing teachers' perceptions of those features.

Table 4.7
Participants' ratings of the importance of TPL features

Teacher professional learning features	Mean	Std. Deviation
Focused on improving student learning	4.29	0.83
Curriculum linked	4.28	0.87
Collaborative	4.21	0.86
Ongoing	4.17	0.95
Focused on developing teachers' skills to engage in EE	4.14	0.82
Focused on improving teachers' knowledge in environmental issues	4.1	0.81
In line with teaching as inquiry	4	0.96
Free of charge	3.99	0.97
Flexible in terms of time and place	3.77	0.88
Available on demand	3.52	0.98

As shown in Table 4.7, for EE teachers, improving students' learning is the most important aim of TPL. This view was supported by the interviewees as well. In the words of one participant:

For professional learning, I would be looking at new ways to improve the kids' learning. I would be mainly looking at new learning opportunities to reflect on problem-solving and complex problems in the real world. Teaching methods that we can do in the classroom to help our student learning. (Helen, interview 1)

There was consistency in participants' answers. As can be seen in Table 4.7, the low standard deviation for each item (TPL aspects) confirmed the agreement among teachers about the importance of these TPL features in EE. The Table shows TPL aspects such as being focused on improving student learning and being curriculum linked were rated higher than TPL aspects related to social media such as being free, available and flexible.

Further, interviewees were asked to clarify what professional learning opportunities they would prefer in EE. Helen claimed she would prefer TPL "with a focus on delivering Education for Sustainability Achievement Standards"(Helen, interview 1). For Blake asking questions and discussion with NZCEA (National Certificate of Educational Achievement) and NZQA (New Zealand Qualifications Authority) experts would work. He was also interested in workshops which enable collaboration among teachers:

I think workshops with other teachers is the most powerful thing you can do. When you get a bunch of teachers together and let them have time to share resources. Also having someone from the NZCEA and NZQA there with that official insight would be helpful as well. (Blake, interview 1)

As Karen clarified in her interview, collaboration is a key in TPL.

I would like going to other schools to see what is going on and learn from their experiences if successful. I think it is good learning in all aspects of the curriculum. Working together and putting resources (journal, books, and water monitoring kit) together as a package to use or having experts available to answer our questions when we needed.

Regardless of the important role of teachers and their professional learning in EE, participants perceived a lack of educational support and teacher professional learning, particularly at secondary level. Helen and Blake, who are secondary school teachers,

expressed clearly that most of their TPL was “pitched at Primary school and even early Childhood centres” (Blake, interview 1).

4.4.3 Teachers’ perceptions of collaborative learning in environmental education

As Helen highlighted in her interview, the aim of professional learning for her is to enhance her teaching practice. To this end, collaboration with other teachers would help:

My students are passionate about learning environmental education, and I have enough content knowledge to teach them. The only thing that I think I need to improve is delivering the knowledge to my students in the way they can use this knowledge to answer NCEA questions. I think I got the knowledge and the passion, so having the conversations with other teachers can improve the delivery to the students. Talking with others would help me to understand the standards and think of ways of doing it and deliver it.

Blake described collaboration with other teachers as follows:

Getting resources or examples from other teachers (especially examples from other students’ work) helps you to know if you are on the right track. Otherwise, you feel you are kind of blind. For example last year, we ran our Level two education for sustainability programme for the first time, and there was no example of other student work. We did use some of the online examples, but for level three there is not really any examples to use. So it is very very difficult to know if you and your students are on the right track. Without that collaboration and without a network of teachers sharing their resources and examples or documents, it is very difficult to know if you are doing the right thing.

Collaboration is not only beneficial to improve pedagogy and content knowledge, but it also would encourage teachers to integrate EE into the school activities. Karen believed “working with like-minded teachers could encourage us to integrate EE into other activities”. The same point was mentioned by Geoff in his interview. Observation of other teachers and school activities was emphasized as a way to encourage teachers and to improve EE teaching and learning. For Karen, visiting other schools to see teachers' work and activities would be beneficial:

Through visiting schools, I can see what other people are doing in their schools, and if they have a successful experience in any environmental related activities, I can do the same. It would help me learn from their

experiences. For example looking at other schools' gardens to find out what kind of resources they use and how they use those resources. So visiting other schools will equip us how to deal in areas which we have some shortcoming.

As described by Geoff and Margaret, collaboration with peers would give ideas to design and conduct environmental activities in their schools. Observation as a learning strategy to integrate EE into the curriculum was reflected in Geoff's interview:

It could help to see what other teachers and schools are doing. Having a look at their lesson plan and look at how they have connected it to the New Zealand curriculum. If you can see the ways they connected their lesson plan and activities to the curriculum, you can learn.

To recap, participants agreed that the most important outcome of TPL is student achievement. Ensuring student success requires enhancing teachers' knowledge and skills: "I need to improve my practice in teaching EE to help my students" (Helen, interview 1). Efforts to improve student achievement can succeed by collaboration. As noted by interviewees, building the capacity of teacher collaboration would help to improve their content knowledge and pedagogy. Participants described collaboration as ways to improve their knowledge and teaching practice through conversation, sharing resources, observing teachers' activities and students' work.

4.4.4 Section summary

Overall, as the findings show, participants' answers appeared to reflect their experiences of various TPL methods. Most participants had experienced some of the traditional TPL methods in EE, whereas participation in a network of EE colleagues through social media was not a common practice among the teachers. The teachers' main concern was student learning and improvement in this area was the most important feature of TPL for participants which is in agreement with the literature regarding TPL (Rutherford, 2013; Timperley et al., 2007).

4.5 Chapter summary

This chapter presented quantitative and qualitative findings which emerged from the questionnaire and interviews focusing on participants' demographic characteristics, teachers' social media usage, their perspectives of EE, and their perceptions and experiences of TPL in EE.

Findings indicated that the majority of respondents were female over 40 years mainly from primary and early childhood settings. Most participants had more than 10 years of experience in teaching with less than 10 years' teaching experience in EE. It also showed that teachers generally felt confident to teach EE.

Regarding teachers' social media usage, in general the teacher respondents mostly use desktop computers at work and mobile phones while they are not at work to engage with social media. Laptop computers were teachers' preferred devices whether at or outside their workplace. Participants mostly were Facebook users for any purposes. However, they used YouTube the most for learning in general and Google+ for professional learning and professional learning in EE. As presented, participants demonstrated a wide range of views regarding utilizing social media for TPL in EE. However, it was reported that participants prefer Facebook for professional learning in EE. Pinterest, Twitter and Instagram had the least usage among participants.

The findings in this chapter showed that among participants social media usage for social interactions with family and friends was higher than networking with peers. Participants used social media more frequently to keep in touch with friends and family. Social media were utilized for learning and professional learning less frequently but were being used for these purposes.

While the majority of respondents had experienced some form of traditional TPL methods in EE, they had less involvement in a network of EE teachers for professional learning through social media. Visiting other schools to see what they are doing in EE was perceived as the most effective TPL in EE whereas self-learning was reported with the lowest effectiveness.

Further, participants were asked to rank their top four preferred TPL methods. It was reported that teachers generally prefer asking questions and discussion with EE experts

in any setting, visiting other schools in order to see what they are doing in EE, formal face to face courses, workshops/hui, and field trips as TPL methods in EE. Regarding teachers' perceptions on different aspects of TPL in EE, improving students' learning was reported as being the most important aim of TPL among participants. Therefore participants' main concern regarding their professional learning was student learning and improvement in EE.

In line with the *Guidelines for Environmental Education in New Zealand Schools*, EE was deliberated to be an important aspect of education. As participants pointed out, improving environmental knowledge, value and skills among students would help to achieve sustainability. Student achievement was perceived as the most important outcome of TPL in EE. To succeed in this goal, enhancing teachers knowledge and skills through collaboration would help. Teachers' collaboration through conversation, sharing resources, observing teachers' activities and students' work would improve teachers pedagogical content knowledge which in turns would improve EE. Chapter 7 discusses these findings and relevant justifications in relation to the literature.

Chapter Five:

Teachers' perceptions of professional learning and professional learning through social media in Environmental education

This study aims to contribute to describing and understanding teachers' perceptions and experiences of professional learning through social media in environmental education (EE). This chapter indicates findings regarding participants' perceptions of this.

This chapter is divided into four main sections. An overview of teachers' perceptions of teacher professional learning (TPL) in EE and the value of social media to facilitate their professional learning in EE, are presented in the first section. Then it presents the key themes emerging from qualitative data in Phase one and Phase two of this research. Teachers perceived various advantages, and some challenges in learning through social media, which shaped the first and second main themes presented in the section two and three in this chapter. In addition, based upon a number of suggestions that were given by teachers, possible strategies to overcome these challenges were identified as the third theme which is described in the fourth section.

5.1 Overview of participants' perceptions of professional learning through social media in Environmental education

In order to identify the ways that teachers view the value of social media to facilitate their professional learning in EE, the questionnaire participants were asked to indicate their agreement with nine related statements. Participants' answers to each statement were defined as an ordinal variable from one to five with strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5). Table 5.1 presents teachers' responses to those statements by calculating the mean and standard deviation for each statement. As shown in the table, teachers consistently agreed with the statements regarding teacher professional learning through social media in EE. Based on the highest mean value, it can be stated that teachers clearly agreed that social media can be used for educational purposes, and that it can be used in EE to provide learning support for colleagues, for collaborative learning, for learning about the environment and sustainability, and for building a professional learning network. There was also some agreement that social media could help EE teachers feel less isolated, to gain digital literacy and to observe peer

practice. The high mean values and the low standard deviation show agreement among the participants regarding each statement (Table 5.1).

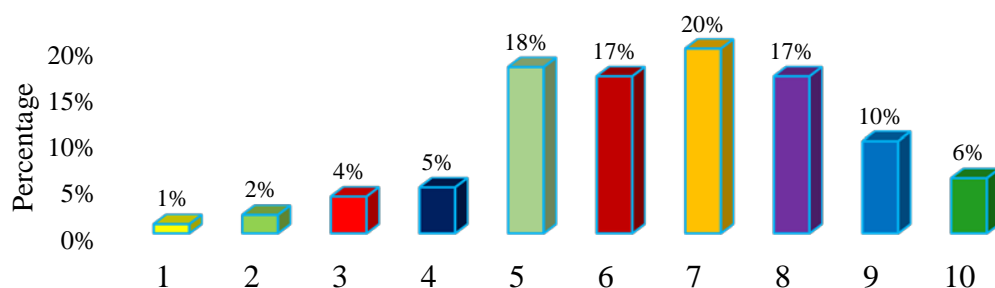
Table 5.1
Teachers' views regarding social media use for TPL in EE

Statements on teachers' views regarding social media use for TPL in EE	Mean	SD
Social media can be useful for EE teachers to provide learning support for their colleagues.	4.08	0.63
Social media can be useful for educational purposes.	4.06	0.63
Social media can be useful for teachers' collaborative learning in EE.	4.06	0.63
Social media can be useful for learning about environment and sustainability.	4.05	0.65
Social media can help to build a professional learning network of EE teachers.	4.03	0.67
Social media could help EE teachers feel less isolated in their work.	3.77	0.73
Using social media for professional learning enables EE teachers to contribute towards digital literacy in the New Zealand curriculum.	3.69	0.76
Social media can be useful for observation of peer practice in EE.	3.55	0.92
EE teachers should be using social media for their learning today.	3.42	0.83

The level of participants' agreement with the statements in the questionnaire indicates that teachers perceived significant value in social media for peer support and collaborative learning. For example, when asked about the usefulness of social media for EE teachers to provide learning support for their colleagues, more than 80% of the teachers answered 'agree' or 'strongly agree'.

The questionnaire provided an overview of participants' opinions regarding the potential use of social media for TPL. To this end, participants were asked to rate the potential of social media for TPL in EE on a scale of 1 to 10 with 10 being the most useful. Figure 5.1 shows participants' responses indicating that most participants rated the potential of social media for TPL in EE to be high by selecting a number between 5 and 9.

Social media's potential for TPL in EE



Participants' rating on social media's potential for TPL in EE

Figure 5.1 Teachers' views regarding the potential of social media for TPL in EE

To analyse the data further, the participants' responses to this question were divided into two groups: ratings from 1 to 5 were considered to indicate little potential, whereas ratings from 6 to 10 indicated high potential. The findings (see Figure 5.2) showed that 68% of participants considered social media to have a high potential for TPL, while 32% saw low potential in social media for TPL in EE. Although more than half of these low potential responses rated the potential as 5/10.

Social media potential for TPL in EE

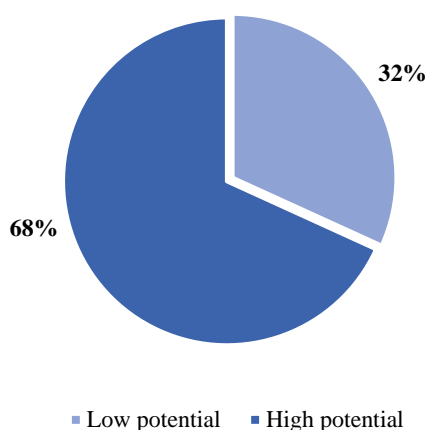


Figure 5.2 Potential of social media for TPL in EE

Participants were also asked to explain the reason for their choice. An analysis of the responses suggests that participants were largely aware of the potential of social media for learning. However, they noted some barriers in professional learning through social media, as one of the participants commented that “social media has its advantages and disadvantages” (T7). The teachers’ reasons for giving the rating they did were related to the way they assessed social media’s strengths and challenges for learning, a topic which is discussed further in the next section.

In order to explore teachers’ interest in joining a social media network of EE teachers, the questionnaire also asked participants to choose a number ranging from 1 to 10 to rate the likelihood of their joining a social media network for EE teachers. Figure 5.3 shows participants’ answers to this question. As can be seen in the Figure, a large percentage of the participants indicated that they would be likely to join a social media network for EE teachers by selection of a number between 6 to 10. As the Figure shows, the number 10 was chosen by the largest percentage (25.5%) of participants.

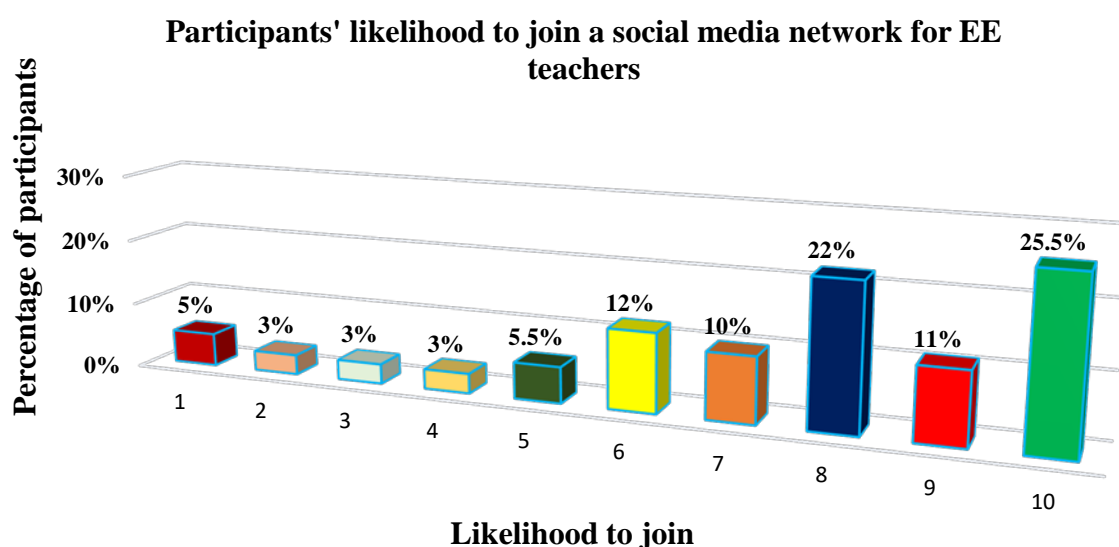


Figure 5.3 Likelihood of teachers’ joining a social media network

In order to get a summary of the differences in participants’ perceptions regarding joining social media for professional learning, the data were further split into two groups as categorical data. When analysing data, categorising such variables into groups can be more informative and useful to compare frequency distributions or descriptive statistics

of the participants. An overall view was calculated by coding all answers (less than or equal to 5 as less likely and answers more than 5 as more likely). The findings indicated that 80.5% of teachers were likely to learn through social media if a network were available while 19.5% were less likely to join a network of EE teachers (see Figure 5.4). As shown in Figure 5.4, a large percentage of the participants stated that they would be likely to join a social media network for EE teachers.

How likely EE teachers are to join a network on social media

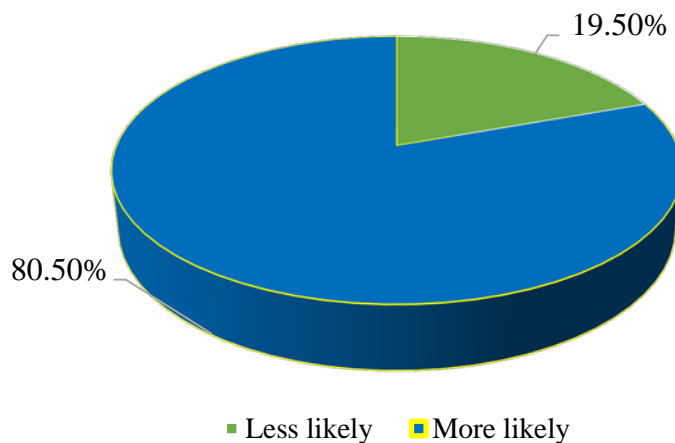


Figure 5.4 Likelihood of teachers' joining a social media network

Further, to provide this study with an holistic view of teachers' preferred professional learning methods, participants were given a question with three options, being face to face learning, learning through digital technology and social media, and a combination of face to face learning and digital technology. Looking at the pie chart (Figure 5.5), it is apparent that a combination of face to face learning and learning through social media was the teachers' preferred learning method, since it was chosen by the majority of participants (65%).

Following the questionnaire, this question was followed up through the interviews. This topic is discussed at greater length in the fourth section.

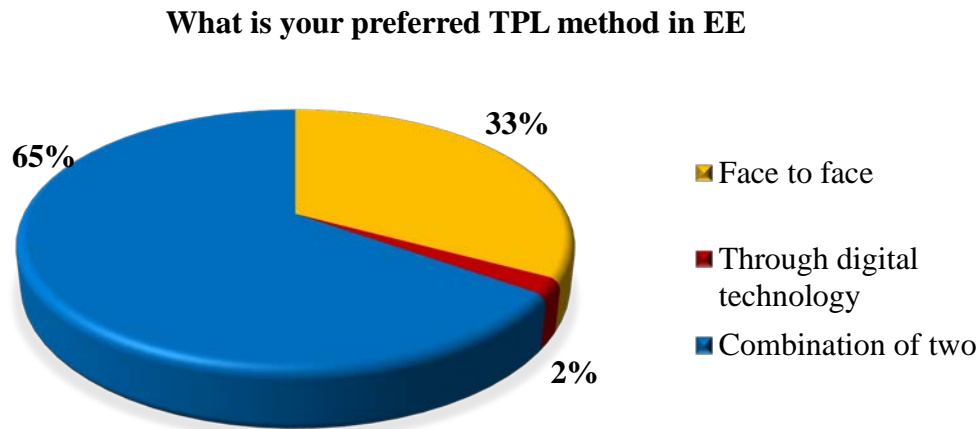


Figure 5.5 Teachers' preferred TPL method in EE

5.1.1 Section summary

Findings indicated that the majority of participants perceived the usefulness of social media for TPL in EE to provide learning support and collaboration opportunities for EE teachers. As discussed, participants agreed with the given statements regarding teacher professional learning through social media in EE. It was stated that teachers believed that social media can be used for educational purposes in EE to provide learning support for colleagues, for collaborative learning, for learning about the environment and sustainability, and for building a professional learning network. Participants also agreed that social media could be used by EE teachers to overcome with isolation as well as improving teachers' digital literacy. However, while teachers identified noteworthy value in social media for peer support and collaborative learning, they were not confident about the ways social media could be used in peer observation.

In general, the questionnaire results showed that a very high percentage of participants would consider using social media for professional learning in EE. Most participants (68%) rated the potential of social media for TPL to be high. The majority of EE teachers (80.5%) would choose to learn through social media if a network were available while most participants (65%) were interested in a combination of face-to-face learning and learning through social media.

5.2 Advantages and possibilities of professional learning through social media in environmental education

This section presents the advantages and possibilities of learning through social media, as they were perceived and described by the EE teachers.

5.2.1 Collaboration and support opportunities for teachers

Findings from the questionnaire and interviews indicated that collaboration could influence teachers in utilising social media for TPL in EE. Collaboration through social media in this study was perceived by the teachers as ways to communicate, share and gain ideas, information, and access updates. Collaborative learning using social media was therefore aligned with the idea of peer support. Peer support for participants meant direct and indirect support regarding ideas, resources, information, updates and instrumental support, or even emotional support. Teachers also saw social media as a way to get updated information regarding environmental issues, teachers' involvement and upcoming activities, as well as TPL courses and programs. Geoff expressed a view of collaboration through social media in his interview, as follows:

I think collaboration through social media would be very good because you can feed off what other people are doing about their projects. It can encourage you, and help you in your projects and your students' learning....the best way to do it would be to have a Facebook group that you can share your ideas, or lesson plan, and the way it links to the New Zealand curriculum. Share what you are doing, or how it is related to the curriculum, or new ideas. It would be good just giving each other feedback or encouraging other teachers, and sharing information, for example about funding or events. Collaboration is really good when we share resources with each other because you can't make everything yourself. If someone else did something which is useful for my class (for example pictures, lesson plan, etc.), I could copy or use it in my class. (Geoff, interview)

Drawing upon her experience, Helen also described different aspects of collaborative learning through social media. As she stated, she found social media useful for collaborative learning through utilizing Facebook in a teacher training course:

It was helpful as we supported each other for our study. We used Facebook for sharing resources, articles, and videos, as well as professional conversation. It was a place to go if I did not know the depth of something. It was useful for sharing resources, sharing ideas. When we

posted any questions on Facebook, somebody answered very quickly. Facebook was a virtual learning environment for us. (Helen, interview 1)

As quoted above, teachers identified different aspects of collaboration in learning through social media. According to the teachers' responses, the main emerging themes for collaboration was access to support including ideas, resources, updates and emotive supports. The key themes across the questionnaire and interviews, which involved collaborative learning, are reported in this section.

5.2.1.1 *Support*

“Collegial support” (T163) was recognized as one of the affordances of collaborative learning through social media (39/134 participants across the open-ended questions). Such support involves direct assistance from colleagues to provide aids and/or materials for teaching (T144), as well as sharing experiences and knowledge (T38) in teaching EE. It also means indirect help through guiding teachers towards the right direction and information (T67). The findings of the questionnaire indicated that teachers had different expectations in terms of receiving support through social media. To get more insights into teachers' perceptions of accessing support through social media, interviewees were asked to clarify what kind of support they would be looking for. Helen said:

Through social media, I would be looking for support around teaching, mainly some of the units. I prefer to get support from people who already have unpacked the unit to share their understanding with me to see what the requirements are. In addition, sharing ideas, sharing assessment schedules, and resources that have been used to deliver EE. For example, when somebody did something that worked for them, I can follow that method and I will not fall into the same trap if a method did not work for them. (Helen, interview 1)

Support for Geoff also involved receiving information and material which could help in teaching EE:

Support for me means seeing what other teachers did, and seeing their lesson plan and the term plan and how they linked to the curriculum. Sometimes it is tricky to make a link between your activities and curriculum. I want to see, could others do better environmental education? Teachers could share, for example, their lesson plan on Google accounts or Facebook. So, other teachers can learn from it or adapt it. That would be the support which I would be looking for. (Geoff, interview)

Helen also praised social media for its ability in terms of providing emotional support, when she shared her experiences of using Facebook for teacher training as follows: “It was a great place to get emotional support as well. When someone was feeling frustrated, he/she could talk to others. It was helpful when we realised that we are not alone and we are in the same boat (Helen, interview 1).

Ideas

Social media’s effectiveness in providing access to new ideas regarding teaching EE was noted by 66 questionnaire participants (66/134 across the open-ended questions). As EE is recommended to be an interdisciplinary approach in New Zealand education, teachers are responsible for integrating EE in other subjects. In this regard, teachers saw collaborative learning with the assistance of social media as being beneficial in relation to accessing ideas about teaching practices (T18). Ideas for connecting students’ activities to the school curriculum and “incorporating EE into schools” (T158) were identified as one of the main aspects of learning collaboratively through social media. However, teachers had diverse needs based on the educational settings, where they worked, and the units, in which they taught. Therefore, their expectations and interpretations of accessing ideas through social media were different. For Margaret, who was an early childhood teacher, “ideas about teaching environmental concepts in a way suitable for 3 or 4-year-old children were important” (Margaret, interview). Geoff was interested in ideas related to his students’ activities and the way other teachers make their lesson plan or term plan, as his statement shows:

I would be looking for the ideas about the things that we are doing, like River Restoration project. I would be looking what other schools are doing to make a plan for next year. I would keep a look on things that would be needed by my school and class, and fit with what we do at our school. (Geoff, interview)

For Karen new ideas would help to solve existing issues and to extend into new areas regarding teaching EE as she asserted in her interview:

New ideas for me are related to developing the school’s garden. So, I am looking to find how and what other schools did in terms of the vegetable garden, composting, and other activities in EE as we have some difficulties in our school’s vegetable garden and composting process. Also, looking at how other schools incorporate EE in drama and dance. (Karen, interview)

Updates

Questionnaire participants (16/134 across the open-ended questions) claimed that they were looking for updated information through engaging on social media. To this end, teachers indicated that using social media would keep them updated on their subject area (T62), environmental issues locally and globally (T100), new initiatives and approaches in teaching and learning methods (T23) as well as “up and coming events” (T2). Access to the updated news, materials and information was Blake’s reason for utilising social media in his daily life:

For me, social media used to be for contacting my friends, but now I also check the news and learn mainly on Facebook. Facebook is my one stop shop, for everything, so that’s news, what friends are up to, and for learning. I am part of the Auckland Geography Teachers’ Association, and PENZ (physical education) group, so I get regular updates from them in terms of resources, ideas, and events. (Blake, interview)

Resources

Looking at the data from the questionnaire, participants (18/134 across the open-ended questions) indicated that they were looking for resources through social media. The participants specified that teachers were interested in accessing resources such as teaching tools (T40) and “practical activities” for students (T19) through social media. Through social media, teachers would have greater (T24) and more instantaneous access to resources (T105). According to the interviewees, teachers would be looking for resources such as “assessment schedules” (Helen, interview 1), “lesson plans and term plans” (Geoff, interview). As an early childhood teacher, Margaret was interested to find resources which could help her in teaching environmental concepts to young children:

Resources such as games that the kids can play, and examples of the lesson you might plan for children. A template for talking about an experience, or a list of books that you can read to the children, or a video that they can watch about environmental related issues. (Margaret, interview)

However, sharing resources for some teachers did not simply mean sharing some reading materials or websites on social media. As Blake clarified in his interview, resources are useful when they are supported by further descriptions and supports:

I would look for those resources that have been used and worked for others. For example, sometimes people share a website, which is not enough. What I would prefer to know is what did other teachers use, or for example how did a web page or an idea help them (like here's a web page, here's how I used it, here's the work students have done out of that learning). So it is a three-step process: resource, learning opportunity and learning outcome followed by an example. So that is what I think makes it powerful and then people can comment on it, which makes it collaborative. (Blake, interview)

5.2.2 Ubiquitous learning opportunities for teachers

As social media provides ubiquitous learning opportunities (T163), it could be useful for teachers with busy schedules. One teacher wrote, "being super busy, but very time poor, being able to access videos etc on social media to support my teaching of EfS is really valuable" (T176). Learning through social media was seen as available, and flexible regarding time and topic. It was also described as time-effective, cost-efficient, and environmentally sound. Learning through social media was perceived to be on demand as well. Drawing upon the data from the questionnaire and interviews, this section explores teachers' perceptions regarding the availability and flexibility of learning through social media which enables ubiquitous learning.

5.2.2.1 Available and flexible

Through social media, teachers have easy access to resources and support based on their priority and interest at any time, from anywhere (T113). Social media "has made the process of learning so streamlined, fluid and time manageable" (T33). Other teacher comments included: "learning through social media can be great and useful. You can do it anytime you would like to do it. Moreover, you can do it in your free time" (T63); and "teachers can view, for example, a video, and review explanations about it; review its related comments and discussions on comment section in their preferred time" (Geoff, interview). Learning through social media is not only available and flexible in terms of time and place, but discussions also can be created around different topics (T162).

Teacher professional learning through social media is on-demand and accessible for teachers when they need it (T113). Teachers "can get instant feedback" through social media (Karen, interview). Therefore, "If a teacher has any questions whatsoever regarding sustainability and EE, the answers can be found quickly and easily on social

media. Sometimes physical networking can take up professional time that we just don't have time for anymore" (T23). Thus, for some of the participants, learning through social media was invaluable. Blake pointed out:

Learning through social media is just timely. You do not have to go anywhere, you get things that are relevant and up to date and people can comment on it and interact. I live two hours away from the town, so for me, if I want to travel, it takes about four hours for me to travel to any workshops or courses. So if I can get it online instantly, anytime, anywhere, and ask questions, it is invaluable. (Blake, interview)

Flexibility was seen to be an important factor in professional learning for teachers. Therefore, while some teachers preferred traditional professional learning methods, they saw the benefit of learning through social media in a flexible and time-saving manner. In this regard, one teacher commented, "my preferred mode would be face to face, but time constraints mean social media is easier" (T5).

In addition, social media offers the possibility of repetition and gives the opportunity for teachers to retrieve information immediately or later, which is rarely offered by face-to-face TPL methods. In this regard, Geoff in his interview said:

I think there is a high value in learning through social media. I can read, I can watch, and I can come back again to remember. If it was on a Facebook page, I can show to my colleagues, and use in my class, I can come back to it and watch it again and again. The problem with traditional professional learning is I can forget, I can get distracted, and I can lose my notes or handout. Learning through social media, I do not want to travel. The information is always available on social media; I can always get back to it and watch it many times until I learn it. (Geoff, interview)

5.2.2.2 *Environmentally sound*

Some teachers argued that learning through social media is environmentally sound as no paper for textbooks and handouts are used. Also, it does not require travelling for TPL. A teacher described learning through social media as "the way forward, accessible, and sustainable in not creating paper waste" (T116). Another teacher wrote, "social media makes learning super easy and super accessible, cheap, and environmentally sound as no petrol is used (T142). Margaret considered learning through social media as EE teachers' responsibility in her interview, when she said, "we are part of Enviroschools, and we think

about sustainability. Workshops and courses are not sustainable either because of handouts and a folder of printed material which are not helpful sometimes” (Margaret, interview).

5.2.2.3 *Cost-effective*

Participants perceived learning through social media as being cost-effective. By comparison with traditional teacher professional learning, learning through social media helped teachers cut down or eliminate costs of transportation, registration, and other expenses incurred by attending classes and courses. A teacher wrote “I do not mind paying sometimes though for high-quality EE, but it is great that social media options are relatively very low cost” (T164). An interviewee clarified it when he said:

Professional learning involves too much travel for me because I’m out in the country, and most of them are a little bit time wasting. So for me, most of the professional learning that I have been on could have boiled down into a 10-minute video on YouTube. So, I would not have to go in the car anywhere and pay \$200 for the course. (Geoff, interview)

5.2.3 *A learning approach for the 21st century*

TPL through social media is seen as a learning approach for the future (T116). Therefore, “going towards the 21st century, learning through social media is the best way to go” (T77). A teacher stated “I think social media is an inevitable part of our future and can be used positively for an array of uses like EE” (T95). With this assumption, even some of the teachers who were not using social media, or those who believed face to face learning is the best way for learning, indicated that they would join a professional learning network if it were available. A teacher commented on the questionnaire as follows: “It seems to be the way of the future and therefore I will embrace if there are no other options. It is an easy tool to use and as long as it stays within the teaching profession guidelines it is all good” (T43). Karen also stated in her interview, “I know social media is the way for learning in future. Therefore, we have to learn and do it” (Karen, interview).

5.2.4 *Access to wider connection and reduce isolation*

Through social media, teachers’ isolation can be reduced without the need for travel. Social media offers teachers the opportunity to connect with other educators,

environmental experts (T91), and administrators (T142), both within and outside their current institution (T113).

A recurrent theme in the interviews and open-ended questions was a sense amongst teachers that learning through social media provided them with wider connections and networking with others. As one participant commented, “it would connect teachers from a wider geographical area so we could connect with a wider group of educational experiences” (T8). Another teacher wrote:

Because I live and work in an isolated area, I would be able to access learning in EE without having to travel long distances, which I have often had to do in the past. I would also be able to connect and learn with a wider group (not just the Teacher fellows I worked with as part of my NZRS Primary Science Fellowship). (T164)

The findings that emerged from the questionnaire and interviews showed that EE teachers were looking for new ideas and successful practices that could help them. However, access to these resources and ideas is a challenging task for teachers. A teacher commented “only social media can provide a platform for such a wide range of educators from all corners of New Zealand to collaborate and share ideas” (T48). Collaboration for those teachers who are in rural areas would be possible through social media, as they do not have a community of teachers in their schools or even in the same area. For example, in her interview Helen said:

I am really frustrated by lack of support as an educator, mainly because I’m teaching in a rural area. I think providing more opportunities for teacher education and resources for teachers through social media would be a good thing to improve EE, as it will be easier for teachers to do it (Helen, interview 1).

Wider connection through social media could reduce isolation, especially for those teachers who are working in rural areas. In this regard, some participants praised social media for its ability to motivate and engage teachers in EE, as connecting to other educators could enhance motivation and keep teachers excited about their activities. For example, a teacher commented on the questionnaire that “social media has the potential to decrease isolation of teachers, and keep them excited and up to date in their subject area” (T60).

Another teacher identified the wider connection on an international scale: “through social media up to date research and ideas from all over the world are shared and can be adapted to our needs” (T71). Networking through social media would enable teachers to contact other teachers and EE experts (T91, T144).

5.2.5 Section summary

In summary, participants perceived social media as useful in order to access support in terms of ideas, updates, and resources. Social media was seen as effective for teachers to access ideas for teaching EE and integrating it into other subjects. Teachers, however, had various needs and expectations regarding accessing support and ideas through social media. For example, one of the interviewees who is teaching in a primary school was asking for support, ideas and professional learning to improve the school’s vegetable garden (Karen). Support and professional learning for high school teachers means enhancing their knowledge to help students through NCEA (Helen and Blake, interviews).

Through social media teachers also were looking for updated information regarding teaching method in EE, environmental issues and environmental events. Resources were suggested, such as teaching tools, material for students’ activities, assessment schedules, lesson plans and term plans. Again, teachers had different needs in terms of resources. For some teachers sharing resources would be useful if the resources are supported further through clarifications. Support also involves emotional support and encouragement from peers.

By engaging with social media, teachers could receive support due to wider connections and access to information and resources. Teachers believed learning through social media is available, and flexible in terms of time and place. This kind of learning was seen beneficial for teachers with busy schedules because teachers could learn based on their priority and interest at their preferred time and place. Learning through social media does not require travelling and consuming paper and other materials. This kind of learning is perceived to be environmentally friendly, time-efficient and cost-effective.

Findings show some EE teachers felt isolated, particularly those who work in remote areas. Social media would be useful in reducing teachers' isolation through connecting and networking with other EE teachers and EE experts without a boundary. In addition, learning through social media was seen as the 21st-century learning approach.

Considering this kind of learning as a method for the future and its advantages, participants believed that teachers need to learn and use social media for TPL in EE.

5.3 Teachers' challenges and concerns of professional learning through social media

The study found a number of concerns and challenges expressed by teachers in relation to social media use for professional learning purposes. Considering learning through social media, participants had diverse interpretations about barriers and challenges faced by teachers. Participants' responses regarding their challenges therefore were quite inconsistent. The following description illustrates some discouraging factors for teachers which prevent them from learning through social media:

All good to know stuff, but doing it is something else. You can read how to make a worm farm, but that does not mean you can or will make the time to do it and maintain it. Social media time is usually extra time outside work hours. It is unpaid and not highly valued by employers. A course with a certificate is seen as something tangible paid for with work budget, done in work time and used as proof for the Education Council³. Social media groups need someone moderating and contributing learning at no charge. (T114)

Looking at the above quote it is apparent that teachers perceived a number of challenges regarding professional learning through social media. The main challenges in the use of social media described by teachers were time, amount and accuracy of information on social media (reliability, validity), and technical challenges (absence of technology, skills and awareness). Lack of trust in use and privacy, and having no interest in learning through social media were also mentioned as challenges. A small number of participants were concerned about other issues which could emerge through utilizing social media for professional learning. Their concerns include: social media is a distraction; learning networks could be temporary, and issues around intellectual property. Teachers' challenges and concerns regarding professional learning through social media are addressed in this section.

³ Monitoring body for teachers' activities and skills to boost the status of teaching, strengthening accountability and bringing consistently high standards across the education system (now known as the Teaching Council of Aotearoa New Zealand <https://teachingcouncil.nz/>)

5.3.1 *Time*

The research findings indicated that many participants were concerned about the time involved doing professional learning through social media. The word “time” was used more frequently than any other word when teachers were asked to indicate their concerns about professional learning through social media (35 times from 122 participants in answers to question 19). Teachers described their challenges as follows: a lack of time to engage in learning through social media; engaging in this kind of learning would have to be done after hours i.e. in their own time; and that learning through social media would be time-consuming. In addition, teachers thought that they had to be online enough already for their work. Therefore, they felt discouraged and uncomfortable spending more time online in order to learn through social media.

Lack of time

“The over-riding barrier to social media’s potential for professional learning in EE is time” (T88). As some of the participants (27/134 participants across open-ended questions) indicated, teachers need time more than anything in order to integrate EE in teaching and to engage in learning through social media. A teacher said, “I already have much knowledge [Masters of Environmental Education with Honors] and experiences, so just need more TIME to enact more EE” (T89). For teachers who normally have busy schedules, finding time to engage in social media was recognised as one of the most challenging tasks regarding professional learning. One teacher wrote, “EE is not the only commitment that teachers have to meet in terms of curriculum” (T27). Another teacher pointed out, “I see its benefits but finding sites is an issue and finding time to access them can be difficult as it is not compulsory in the curriculum” (T12). The same feeling was described by another teacher as follows, “I am an Area School teacher, and I have too many hats already. As much as I feel for EE, I can't add this to my "hats" as well” (T94). As quoted above, some participants admitted that TPL through social media is “another add-on” (T84), while EE is not the main aspect in NZ curriculum (T12) and teachers already have enough to do (T55).

Time consuming

Some participants (13/134 participants across open-ended questions) claimed that learning through social media can be time-consuming. On social media, teachers “can get

side-tracked easily and waste a lot of time” (T98) due to unrelated (T148) or inappropriate posts (T138), a large number of posts (T142) and “other aspects of social media” (T139) such as unprofessional posts. One of the participants gave an example when they were asked about their concern about learning through social media. He indicated his concern is time-wasting messages on social media. For example, “NZ Teachers (primary) [New Zealand primary teachers Facebook page] has so many postings, and comments and time wasters that I had to block it from my Facebook feed. I go to it in the weekends to check out any good ideas” (T142).

After hours’ time

It seems from teachers’ answers to the questionnaire that their concerns were not only related to a lack of time to engage in learning through social media, but they also were concerned about investing their free time for learning. Some of the participants (9/134 participants across open-ended questions) pointed out that time to engage in learning through social media “is usually extra time outside work hours” (T114) that would “take up teachers’ personal time” (T130). As one teacher stated, “to be involved with social media you would need uninterrupted time and that is in the evening round. This would impact on work-life balance which is near impossible to achieve as a teacher” (T10).

Spending too much time online

There was also a perception among participants that teachers are frustrated in spending their time on social media for learning (9/134 across different questions) because they already have to spend a lot of time online for teaching and learning purposes. Participants claimed that learning through social media means, “more screen time” (T40) for teachers who already have to spend a lot of time on the computer during the day (T10). On being asked how you would rate social media’s potential for your professional learning in EE, a teacher mentioned: “a moderate response to reflect my hesitation in potentially spending yet another period of time in front of a screen” (T40). Therefore, in order to avoid spending more time online, some participants preferred face-to-face learning. The following is what a teacher expressed: “I feel that I spend more time in front of a screen than I should and prefer more face-to-face interactions” (T30). Another teacher wrote, “I have received almost 400 emails which I have to consider, process and answer in the last 5 weeks. I really do not care for more time online” (T170).

However, teachers' concerns regarding *time* were not particularly prominent in the interviews. Therefore, to get insights into how teachers think about "time", whether as a barrier or not, the interviewees were asked to clarify to what extent might the time it takes to learn through social media be an issue for them. Drawing upon what the teachers said in their interviews, I identified at least four different types of interpretations they had regarding "time" as an issue to learn through social media in EE. Blake, for instance, pointed out: "I do not think that time is a barrier. Every teacher that I know is online; every teacher that I know has a Facebook account, so it is very easy to learn through, for example, Facebook. There are no barriers at all". Karen believed it is a matter of time management as she clarified: "Time is always a problem for learning. However, still, there is a place for learning. As teachers are time poor, they need thinking and reflecting and more balance in their lives to do professional learning". Helen also said: "it comes down to what are my priorities and I just have to balance all my commitments".

Professional learning through social media for others, on the other hand, was seen potentially as a time-consuming method. However, utilizing a straightforward platform could mitigate this barrier. As Margaret said: "teaching is a very busy job. If professional learning is accessible and easy, you will look at it, but if it requires clicking here, clicking there, downloading this and that, then people will not come to it" (Margaret, interview). Geoff, on the other hand, expressed his view as follows:

If the professional learning took about one hour of looking through posts, I would actually think it is too long and won't continue. But, if it was a 5-10 minute video, or a photo with a little paragraph underneath, explaining about an issue or the way they did a project, I would use it, and I know many others would too. (Geoff, interview)

In summary, time was seen as the main concern for teachers regarding learning through social media. Participants describe their concerns as:

- A lack of time to engage in social media for learning as teachers have busy schedules
- Time-consuming nature of social media due to a large number of related and unrelated information
- Learning through social media is an add-on for teachers as they have to engage in learning through social media mostly after hours and spend their own time as they do not have time during school hours

- Teachers were discouraged to learn through social media, because it requires using digital devices and looking at the screen.

5.3.2 Information

As mentioned in the previous section, social media's strength is that it facilitates information sharing, which in turn could improve teachers' knowledge and provide access to resources. However, this strength of social media was mentioned as one of its drawbacks because of the huge amount of unreliable information posted.

The amount of information and unfocused information

On social media, teachers are overwhelmed with large amounts of information (T91) which is often not very focused (T34). One teacher felt that teachers were inundated with a flood of information and posts on social media while having to teach (T55). Another teacher pointed out that in order to learn through social media “we end up looking at our phones and computers more than we look at the children” (T124). In addition, through social media, teachers were exposed to large quantities of unfocused information. Therefore, they may be unable to focus on one topic as it takes teachers time to find relevant information on social media (T142).

The accuracy of information

As seen in section 5.1, through the questionnaire teachers were asked to rate the potential of social media for TPL from 1 to 10. One teacher, who gave a rating of five, clarified her reason as follows: “Because I’m not sure how reliable the information on social media would be” (T4). It seemed that teachers were concerned about the reliability and validity of information shared on social media (T78). In this regard, participants expressed a variety of perspectives. One was concerned about the reliability of information shared (T116), which could be viewed and passed on through social media (T100). Another teacher wrote that excessive information on social media which could grab teachers’ attention might be “someone’s opinion and not necessarily factual” (T176). Another one was concerned about “the influence of people's perspectives and the long-term values this could portray” (T173).

Peoples’ views on social media were considered as its drawback. It was also seen by one participant as a reason why learning through social media is time-consuming. She

asserted: “Social media is a good tool when it provides fact-based information. Sometimes people’s opinions on forums can mean you have to spend a lot of time wading through large numbers of comments in order to glean a very small amount of useful information” (T102).

5.3.3 Technical challenges, lack of technology, skills and awareness

Learning through social media depends on “computer resources and cost” (T53), and “access to internet and technology to use it” (T64). Therefore, accessing required technology was mentioned as one of the challenges for teachers regarding learning through social media (9/134 participants across open-ended questions). Schools’ budgets for providing internet and new technology also “would dictate whether social media was used or not” (T133). In addition, two participants indicated that some social media platforms are blocked by some schools’ servers (T82, T153).

As mentioned in section 5.1, the questionnaire explored teachers’ interest in joining a social media network of EE teachers. A large proportion of the participants (80.5%, $n = 145$) stated that they would be likely to join a social media network for EE teachers. However, findings across open-ended questions indicated that some of the participants (14/134 participants) would consider social media for learning if it were easy to use. It was also mentioned that some teachers have no skills or experience to use social media for their learning (13/134 participants). One teacher felt that learning through social media is an extra burden on teachers because it requires skills, which they are “expected to have with no training or time” (T90).

The results of the survey also indicated that while teachers were aware that there is potential for greater professional learning through social media, they were not familiar with using it for their professional learning in EE in particular (T92). In this regard, a teacher wrote, “I believe this has a lot of potential but I am not part of any collaborative groups using social media for this purpose (nor do I know of anyone who is)” (T47). Another teacher put it this way, “I feel it possibly could help but I have not experienced this yet and am not aware of what is currently available” (T31). As some teachers stated (5/134 participants), currently there is no TPL network available in EE in particular, and teachers “do not receive any offers of collaborative learning through social media” (T62).

5.3.4 *Privacy concerns, and online Behaviour*

From qualitative analysis of the questionnaire, it is apparent that participants were aware of and concerned about privacy risks they faced on social media (12/134 participants). Therefore, teachers' confidentiality was seen as an important factor to shaping the likelihood of their joining a social media network for EE teachers when they were asked to indicate their interest. Another viewpoint to consider in this regard was the perception of the participants regarding online behaviour on social media. "Poor online behaviour and not observing codes of conduct" (T60) were recognised by participants as one of the barriers of learning through social media (5/134 participants). As such, teachers' comments included, "I personally feel that on social media there are always negative people" (T132) "that should not be [on social media]" (T118), and teachers have "challenges about everyone joining or people not following digital protocols" (T77).

5.3.5 *No interest in learning through social media*

Teachers also indicated that they were not interested in learning through social media due to a variety of concerns. One concern was that social media could not afford teachers the same opportunities and feelings of being a part of a community that occurs in face-to-face interactions. As "teaching is about knowing people and relationships" (T52), one teacher found "face to face, personal visits and interaction, to be of prior importance". As she explained, "with social media it is highly possible for people to talk the talk. Personal interaction shows those who can walk the walk" (T172). Another teacher wrote, "I am a people person, a down to earth person. Our tamariki need to feel the mana and wairua of people and the land that surrounds them. You can't learn those feelings on social media. You can miss out on face-to-face interactions" (T56).

Drawing upon participants' perceptions, it seems that for teachers it is "important to maintain human contact (T30)", because "a virtual relationship is nowhere as good as a real one" (T81). In this regards, one teacher stated, "we need more intimate, face-to-face contact to create real, sustainable communities; social media tends to be box ticking, although it has its uses" (T130). Another teacher commented, "I am not particularly interested in social media. Too disconnected for how I like to interact or develop a relationship with people" (T165).

Concerns about losing face-to-face interactions were mentioned as another drawback of TPL through social media by 38 of the 134 participants. Findings indicated that teachers were in favour of face-to-face learning to “maintain human contact” (T30), “being able to determine the actuality of situations that are being espoused” (T172), and “getting a feel from the surroundings” (T167). Therefore, one teacher valued the face-to-face dialogue and cluster meetings as most valuable in lifting her knowledge (T98). This view was expressed by another teacher in the following quote:

I believe that there is a place for social media. However, I believe that hands-on and face to face are more effective learning tools because you are using more of your senses, you are able to question, which in turn makes the experience more memorable and more likely to effect change (learning) (T52).

As seen in the quote above, the conflict between EE as an applied subject and learning through social media was another area of teachers’ concern. It was evident from the teachers’ responses that they believed EE was a “practical subject and for the hands-on type of learner” (T10), while through social media “all senses are not engaged and teachers do not get outside and get their hands dirty” (T81). Therefore, one teacher wrote, “I would hate to see engagement in nature to become engagement with technology out in nature” (T64). Also, as opposed to a group of teachers who believed learning through social media mitigates isolation, one teacher claimed that by using social media for learning, teachers would be disconnected from others and “become more isolated from colleagues” (T52).

In addition, learning through social media was not viewed as optimal instruction for teachers because this kind of informal professional learning is “unpaid and not highly valued by employers” (T114). It seems that teachers believe “the investment of time/commitment to learn through social media may not be formally recognised by the teaching profession. Such “informal TPL is not currently recognised or valued via the PTC’s [Practising Teacher Criteria, Teaching Council] and teacher appraisal/attestations” (T84). The idea of learning through social media therefore meant extra work (T166) or another add-on (T84) which often gets shelved due to teachers’ priorities (T90). Therefore, as one participant commented, teachers “would be reluctant to engage in learning through social media, as it is an extra thing to keep up” (T166).

5.3.6 Social media is a source of distraction

One teacher was concerned about “getting bombarded by other things while learning” (T148), as “other aspects of social media can distract the user from focusing on the main reason for using it” (T139). A view among teachers was that as some people used social media as a “platform/soapbox” (T65), teachers “can get side-tracked easily and waste a lot of time” (T98). In order to clarify this point, one participant referred to platforms like the New Zealand primary teachers Facebook page (NZ Teachers (primary) as an example and claimed that social media diverts teachers’ attention away from real learning and can disrupt the learning process. As he indicated, “trolls hijacking discussions and unprofessional posting could distract teachers from more meaningful pursuits” (T83). In essence, teachers viewed learning through social media useful if it was “a focused, dedicated area without all the other garbage that can come on social media” (T113).

5.3.7 Concern about having a temporary learning network or downgraded information

Learning through social media seems promising at first glance but “many initiatives are started and are not sustained” (T47). Creating and maintaining a social media group needs cooperating and monitoring contiguously to keep it updated. If it does not get updated teachers will lose their interest quickly (T156) and the social media learning group “will die” (Blake, interview). Active members are the key elements to keep a learning network alive and updated. This point was mentioned by Blake in his interview:

I use social media for other subjects but not EE just because there are not enough people. The key thing is that having regular and updated posts. For example, with the geography ones there are regular posts, but not with Environmental education (Blake, interview 1).

5.3.8 Intellectual property, copyright and infringement

One early childhood teacher was concerned with intellectual property regarding using social media for learning. She claimed that the “issues around intellectual property, plagiarism, copyright and infringement are matters that need to be considered”. Social media is used by childhood centres and primary schools to show their activities as part of marketing. As Margaret clarified in her interview, “social media has a competitive nature,

especially for early childhood”. Thus, resources which are shared on social media need to be considered as intellectual property (Margaret, interview).

5.3.9 Section summary

The findings in this section indicate that teachers were concerned about some barriers and perceived a number of challenges regarding learning through social media.

The teachers’ main concern about learning through social media was time. Teachers described learning through social media as time-consuming, time to be online after work while they felt that they do not have enough time. Teaching was seen as demanding job which requires time. However, further analysis of open ended questions aligned with teachers’ answers to the interview questions appear to indicate time is a complex issue. Time is the issue because, on one hand, there is no specific learning network for TPL in EE and teachers have to spend the time to gain related and useful information through different pages. On the other hand, teachers do not have a strategy, a purpose and motivation to learn on social media in EE as they felt EE is not a compulsory part of the school curriculum. It seems that because EE is not the main aspect of the curriculum, TPL in EE is not teachers’ priority and they felt that they do not have time to engage in learning through social media. Also, participants indicated learning through social media is time-consuming and teachers have to find information from different pages and resources. In its essence, social media can be overwhelming with information and can be a source of distraction when it is not focused to a teacher’s interest. In addition, it was believed that TPL through social media is not only time consuming and unpaid work that teachers have to do outside work hours but also is not formally recognised by the teaching profession.

Participants perceived that they needed technical support, skills, and awareness in order to be an active member of a learning network for EE. Teachers were also concerned about privacy risks and online behaviour. While, in general, teachers perceived advantages in learning through social media, they were concerned about losing opportunities for face-to-face interaction and practical learning, as they believe teaching is a social activity and EE is a practical subject. Therefore, some participants indicated that they are not keen on learning on social media. In addition, one of the participants was concerned about other issues such as intellectual property and copyright while using social media for collaborative learning and sharing resources. Despite all these challenges, to make the

best use of social media for learning in EE, teachers identified a number of strategies which are discussed in the next section.

5.4 Possible strategies to overcome challenges of teacher professional learning through social media in Environmental education

As mentioned in Chapter three, this research focuses on understanding the different strategies that teachers use to learn from or with other teachers or experts through social media, along with its advantages and barriers. The findings showed that teachers identified some challenges regarding learning through social media. However, some possible strategies to overcome these challenges were articulated by participants. Based upon what the teachers commented on the questionnaire, I could identify at least four strategies. Using different networks for different years and subjects, combining face-to-face learning and learning through social media, utilising an easy platform and straightforward network, and having an administrated closed group for EE teachers were suggested. The following figure (Figure 5.6) presents possible strategies to overcome barriers of TPL through social media in EE and these are discussed in the following subsections.

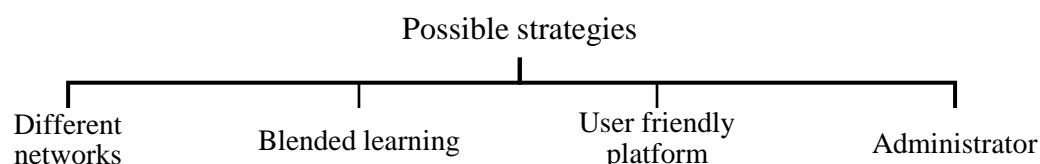


Figure 5.6 Participants' suggestion to overcome barriers of TPL through social media

5.4.1 Using different networks for different years and subjects

As seen in the previous section, participants stated that learning through social media is time-consuming, and teachers have to spend hours on social media in order to find related and useful information. However, learning on social media does not have to be time-consuming if it is focused. In order to develop a focused learning network, a variety of ideas and suggestions were provided by teachers (13/134 ideas across open-ended questions). It seems from participants' comments on the questionnaire that teachers were

interested in a network “specifically for EE” (T54) with learning materials linked to the curriculum (T38). Teachers also suggested having “a specific medium for like minds to share information” (T71) or for collaborating regarding “specific topics” (T133). Teachers’ learning networks could “be divided into sectors or demographic communities” (T92). Social media therefore could provide “connections with others that are focused on the same inquiry path” (T156). For example, in his interview Geoff mentioned:

I do not know any teachers’ network in environmental education other than the NZ Teachers (primary), which is general. The problem with the page is that it gets about 50 posts a day. It is too wide, ranging from different year levels and subjects. It would work better for me if there was one page for year one and two. It means different pages for different years and even different subjects. For example, if I want to search and find something about environmental sciences, it would take me an hour to scroll down the page and check all posts to find relevant posts. It needs to be more specific and then I think it would work really well. (Geoff, interview)

5.4.2 Combining face to face learning and learning through social media

As mentioned in the section 5.1, blended learning was the teachers’ preferred learning method, since it was chosen by the majority of the survey participants (65%, n= 153). In considering the advantages of learning through social media, a combination of face-to-face and learning through social media was suggested by 23 of 134 participants across open-ended questions. One teacher said, “I think social media can be really useful but I don’t want it to be the only driver. My preferred mode would be face to face but time constraints mean social media is easier” (T5). Another participant shared her view as follows: “social media can be a useful tool to support hands-on real experiences, not replace them” (T81).

As mentioned, one concern shared by participants was that there would be a lack of face-to-face interaction with other colleagues and fellow teachers as a consequence of using social media. Teachers believed knowing other teachers and building a professional relationship could help them to interface with others. In addition, as EE is an active curriculum, it should be supplemented by social media (T105). One participant asserted that “it would be helpful to meet people at least once in person before, then embarking upon working collaboratively online” (T47). Another teacher stated:

In my opinion, a social media network of EE professionals would be best initiated following an intense short and inspiring face-to-face course/conference/workshop where relationships are established then continued. The impetus to join and contribute would be heightened by this initial encounter and shared experience (T88).

This was reinforced by another teacher's comments: "It is important to value relationships formed by face to face contact when developing professionally, as well as utilising and sorting the wide range of information available through social media" (T173). Findings from interviews also showed that teachers would like to have an introductory course in their preferred area first, then learn about it through social media. This course would provide them with some background information and enable them to meet like-minded teachers in advance. A network of teachers could then be established, based on the topics which they discuss during the face-to-face learning sessions (Helen, interview 1).

In addition, teachers thought that knowing who to talk to could be rewarding in terms of privacy and the accuracy of information. Therefore, meeting others prior to learning through a network would provide participants with the opportunity to get to know other members of the learning network and to share their concerns and ideas. However, providing face-to-face learning would be problematic as many teachers teach in remote areas. In this regards different ways to alleviate the issue were suggested by participants. Having only a face-to-face meeting before starting online learning (T47), and/or the adoption of video conferencing technologies such as Zoom were proposed (Helen, interview 1).

5.4.3 Utilising a user-friendly platform, a straightforward network and a closed group

Joining a learning network for a teacher was dependent "on the set up of the network, the ease of use and commitment required of the user" (T173). A teacher wrote that time is precious, so any learning network for EE teachers "would have to be VERY easy to use and not any more demanding" (T115). This point was mentioned in the interview when Helen said:

To me ease of use is important. I love using technology so I would prefer the one which is easier to use. It is just like driving a car. I enjoy driving but I do not care about the engine and the way it works. I just want it to work all the time, and I enjoy it. Therefore, for social media also I do not want to become a technical person but only a user. However, because my

students use different media, I would like to use different tools to keep up with them (Helen, interview 1).

As participants expressed, utilising a user-friendly platform and a straightforward network would increase the chance to use social media for learning, because it does not require special skills and time spent learning. In this regard, Karen claimed that she would be interested and would join a social media network “as long as it is easy to use”. On being asked about her interest in using social media, she stated: “If the learning platform is straightforward and does not require login to other platforms or websites, I would be interested in using it” (Karen, interview). Another teacher shared her view as follows: “if it is an additional and marginally effective platform, I would lose my interest quickly. I am more likely to use an established platform if it is responsive and I have active peer connections” (T156). The survey respondents across open ended questions also mentioned Facebook as an established, user-friendly platform (12/134 participants) for learning. In the words of one teacher:

It would be better to use a platform that teachers are already on (e.g. Facebook). Initiatives that were a 'new' social media (such as Pond) were not effective as it meant that teachers had to log in to somewhere else to get to it, which they simply did not do (T163).

Another participant described her experience of collaboration through Facebook as follows:

I have found Facebook in particular very helpful. I was awarded a New Zealand Royal Society Primary Science Fellowship. My particular focus was EfS within a Wetlands context. Many other fellows also had an EfS focus to their topic of Inquiry. We communicated through a closed group via Facebook. This was very valuable for collaborative and professional learning (T164).

All interviewees also indicated that they would prefer Facebook as a learning platform. Their reasons were lack of skills for using other platforms, popularity and wide use of Facebook, and the ease of use of current Facebook pages for professional learning. Blake stated: “I would choose Facebook, just because it is what I use and it is simple” (Blake, interview). Wider use and popularity of Facebook is expressed by Geoff as a reason for using it for his professional learning:

I would choose Facebook because everyone I know has it, and everyone knows how to use it. Also, it's a good way of storing the information, so I can go back and look at it again, and I can share with others as well. People have already used Facebook and trusted it. There is no point to use a new platform because teachers have to learn it. (Geoff, interview)

Margaret shared a similar view when she was asked what platform(s) she would choose if she was invited to join a teacher professional learning network or a programme through social media in EE: "I would probably choose Facebook because it is easy and it already has some environmental pages, which I can use" (Margaret, interview). Talking about collaboration and learning collaboratively through social media, Helen said:

I have found Facebook useful. I cannot say this about other social networks, as I have not really used them too much. However, if other people have found something particularly well, that has to be good enough for me and I am quite happy to digitally jump and learn something new. (Helen, interview)

Having a closed learning group would improve the quality of information shared on social media. In this regard, one participant said, "some people put up trivial (or worse "off colour" things) that are not related to the topic you are interested in e.g. EE or EfS. This doesn't happen ordinarily if it is a closed Facebook group though" (T164).

5.4.4 Administration

As some participants expressed, a learning network for EE teachers "would be effective if well managed and administrated" (T83). The role of an administrator was directly mentioned in order to overcome some of the barriers of learning through social media (4/134 participants). One teacher wrote, "social media groups need someone moderating and contributing learning" (T114) when she talked about her concerns about learning through social media. A teacher wrote "social media can be full of crap (e.g. teachers' page on FB). This makes it hard to sift through to get to the good stuff. It may require a moderator" (T89) to monitor "what gets said and put on" (T111). This would also help to overcome the "challenges about everyone joining or people not following digital protocols" (T77) which improves the reliability of information as well as teachers' privacy.

Some comments, on the other hand, could be interpreted as the role of an administrator. An administrator could support (T69), update the network (T57), and make sure the

information is accurate and well informed (T3). A learning network would need to be interactive, updated regularly, and used widely for best results (T57), otherwise “teachers’ interest would fall away over time” (T139). Therefore, in order to sustain a learning initiative, a group administrator could keep a network fresh and updated.

5.4.5 Other suggestions

Other than the strategies above, participants suggested some approaches in order to make the best use of social media for learning. On being asked about teachers’ concerns regarding professional learning through social media in EE, a teacher commented that “It would just be hard to know how useful or effective it would be until it was trialled” (T31). It seems from her comments on other parts of the questionnaire that she had not experienced learning through social media and she was not aware of what is currently available. Accordingly, another teacher suggested that it would be useful to make all teachers aware that a learning network is available (T168).

The role of members in creating an effective learning network was considered when a teacher wrote: “the potential use of social media for learning is enormous for gathering and sharing information, it's how we use it that is the key” (T117). The same point was mentioned by another teacher in her quote: “social media is just another tool, avenue and mode for TPL. The potential for any tool is only what people seek to make it” (T91). In this regard, the importance of collaboration for learning was also considered. A teacher wrote, “If whole staff groups were taking part in it that would be better than isolated teachers trying to take on the whole thing” (T55).

In contrast to a group of participants who suggested having different networks for different sectors, demographic communities or topics, one teacher claimed that an online learning network would need care otherwise it may end up focused on one specific area (T5). Other teachers’ comments included: learning through social media “could be useful for ways to teach sustainability but needs to be time appropriate, not too long (T67); “it needs to be quick bites” (T147); and “this place would need to be interactive and updated regularly and used widely for best results” (T57).

5.4.6 Section summary

Overall, to overcome social media barriers for TPL, using different networks with a focus on particular years or subjects were articulated by participants as it would help teachers to spend less time on social media. Findings also showed that teachers were aware of the advantages of learning through social media. However, they did not want to replace face-to-face interaction with other teachers especially in EE which is an active curriculum with learning online. Therefore, a combination of learning through social media and face to face learning was suggested by some participants as a learning method in EE. Furthermore, for some of the participants engaging in TPL through social media was dependent upon utilizing a user-friendly platform and straightforward network. For example, Facebook was suggested by some participants because of its ease of use. Some participants believed TPL through social media in EE would be effective if a platform or network of teachers was administrated. An administrator could manage the network and check the posts in order to remove unrelated information, which in turn increases validity and reliability of the posts. It would reduce the time required to check the posts and teachers would be able to find information in a time-saving manner.

5.5 Chapter summary

This chapter explored teachers' perceptions and experiences of professional learning through social media in EE. To this end, the chapter was divided into four sections.

The first section showed that teachers would consider using social media for professional learning in EE. It was specified that teachers perceived social media useful for TPL in EE. Social media would enable teachers to access learning support and collaboration opportunities. It was also indicated that teachers were not assured about peer observation through social media. Generally, the majority of participants claimed that they would consider using social media for professional learning in EE. As it was indicated, most participants have rated the potential of social media for TPL to be high and they would choose to learn through a social media network for EE teachers. However, in the comparison between learning through social media and blended learning, most participants were interested in a combination of face-to-face learning and learning through social media.

The findings in the second section emphasised that participants perceived the usefulness of social media as enabling teachers to access support in form of new ideas, updates, and resources from other peers, and experts with no limitations on time and place. However, teachers' interpretations of support depend on the educational settings in which they work. Each school or centre has specific needs. Therefore, different teachers have different expectations regarding professional learning in EE.

Social media was considered by participants to be available, flexible, an environmentally friendly and cost-effective way to make useful connections with educators beyond their schools and region. Learning through social media was seen a learning approach for the future as social media could provide teachers with access to wider connections and different types of information resources which would help to reduce the isolation of teachers.

Despite social media affordances for TPL, teachers identified some barriers regarding learning through social media in section three. Time, information, technical challenges, privacy, and a lack of interest in learning through social media were teachers' main challenges. The distracting nature of social media, having a temporary network and neglecting intellectual property and copyright were also identified as participants' concerns regarding learning through social media. It was clear that time was seen as teachers' main concern in relation to perceived challenges of learning through social media. However, analysis of the data revealed that "time" was a complex issue in itself, and was related to other issues such as teachers' priorities in learning, the large amounts of unfocused information on social media and teachers' lack of skills to use social media for learning in particular.

The last section reported teachers' suggestions to overcome teachers' challenges regarding TPL through social media in EE. Teachers identified having an administered closed group, easy and quick access to the network, and straight to the point information as the strengths of a social media network for learning. Teachers also suggested that having different social media groups for various educational settings and subjects could save teachers' time. A common recommendation amongst participants was that a combination of face to face learning and learning through social media would be teachers' preferred learning method.

A recurring idea was a sense amongst teachers that social media is helpful if the information is relevant, linked to the curriculum, clear to navigate and engaging. Considering findings presented in this chapter, it is possible to suggest that social media would help TPL in EE.

Chapter Six:

A learning community through social media

In order to explore teachers' perceptions and experiences of professional learning through social media in environmental education (EE), this study was continued into a third phase to trial a learning community through social media based on the research findings from previous phases and the theoretical lens of connectivism. This chapter begins by outlining the Phase three aims and then describes the way in which the research findings were used in this phase of this study. The chapter then includes interpretation and reporting of findings of the phase. A summary of Phase three process and findings completes this chapter.

6.1 The research aims in Phase three

The research aims in Phase three can be summarised as follows:

- To further investigate teachers' activities, wants and needs regarding learning through social media in EE.
- To explore how a group of teachers who engage in learning through a community on social media believe this learning may have impacted upon their teaching practices.
- To explore how teachers perceive the potential of a specific platform and/or social media for use in teacher professional learning in EE.

6.2 Implementation of findings from Phase one and Phase two into third phase

The purpose of this section is to show the reasoning underpinning the third phase of this study. The third phase of this study, from preparation to data gathering, was supported by literature and associated with findings that emerged from the questionnaire and interviews in previous phases. This section therefore discusses the rationale and justifications for continuing the study in the third phase, which used Google+ as a social media platform and focused on secondary school teachers as based upon the research findings from Phases one and two.

6.2.1 *The basis for Phase three*

Findings from the previous phases, one and two, showed a lot of interest from teachers in joining a social media network for professional learning in EE if such a network were available (77% of questionnaire respondents and all interviewees). Findings from the questionnaire also indicated that learning collaboratively could inspire teachers in utilising social media for TPL in EE. Teachers perceived collaboration through social media as enabling them to access support (32/135 times across the open ended responses in general) and resources (19/135 teachers across the questionnaire who answered the open ended questions) with less limitations on time and place. Social media's effectiveness in providing support regarding teaching EE was noted by 16 questionnaire participants who responded to a question about what a new social media learning network could provide for teachers (out of 120 who answered this question). These findings were confirmed by interviewees later in Phase two. They perceived collaboration as communication with colleagues, sharing and gaining ideas, information, and access updates (Geoff, Helen interviews).

To deepen my understanding of teachers' perceptions and experiences of professional learning through social media in EE, the study was planned to continue into a third phase to trial the research findings from Phases one and two. The platform would enable synchronous and asynchronous communication and interaction between group members. After providing such a learning opportunity for teachers, they would be asked how a social media platform, could function as a means of providing collaboration opportunities for EE teachers. This phase also would observe how a group of EE teachers engage with a social media community for their professional learning in EE. This phase would provide a better understanding of teachers' perceptions and experiences of professional learning through social media in EE.

6.2.2 *Selection of social media platform*

With reference to Chapter 3, in line with a phenomenographic approach, participants were asked to identify a suitable platform for their professional learning in EE as part of the questionnaire and interviews in Phases one and two. Facebook appeared to be the preferred platform with 51% of questionnaire participants and all interviewees indicating that they would choose Facebook for their professional learning. However, further analysis of data clarified that teachers' main challenges in using social media were

associated with Facebook. In particular, Facebook was regarded as a source of distraction because of the large number of posts and the number of Facebook users. Teachers' experience of Facebook contributed to their perception that social media would be time consuming. Therefore, learning through social media could be perceived as time-consuming for teachers. This point was clarified in the initial Zoom meeting with the Phase three participants as well (see Section 3.2.2). Therefore, Facebook was not chosen as a suitable platform for Phase three.

Findings also showed that many teachers use YouTube for learning. The majority of the first phase participants indicated that they use YouTube for learning in general (70%), and for professional learning in particular (55%). However, interpretation of data showed that teachers do not recognise YouTube as social media because its use is confined to viewing, rather than to production and sharing contents or resources. For this reason YouTube was rejected for Phase three.

By comparison, after Facebook, Google+ was the second most suggested social media platform to be used for TPL in EE (see Figure 4.4). In terms of questionnaire responses, Google+ was seen as a popular social media platform for professional learning (57%) as well as professional learning in EE (49%). The use of Google+ for professional learning and professional learning in EE was therefore higher than Facebook and YouTube (see Figure 4.3). In addition, Google+ is part of Google Apps which is currently used in New Zealand schools as an educational tool. Teachers are familiar with Google+ functionality and features and it could provide learners with all of the benefits that social media can offer. Based on these findings and a number of suggestions and possible strategies given by participants, Google+ was chosen as the social media platform for Phase three.

As teachers were concerned about their privacy and time spent on social media, it was interpreted that having a closed group of EE teachers on Google+ might improve participants' privacy and mitigate their challenges regarding time. In this way, teachers would use the Google+ group only for professional learning in EE and would be able to separate their personal network from their professional network. It would be used to connect EE teachers and experts through a closed group called EEfS (Environmental Education for Sustainability) Community. The community was named EEfS to reflect the new Strategy and Action Plan for 2017–2021 in New Zealand (Department of

Conservation, 2019). This continues to foreground the EE for environmental education but also focuses on sustainability.

In summary, there were several key reasons for utilising Google+ in Phase three of this study:

- To keep personal and professional learning networks separate (e.g. Facebook was popular for personal use).
- To follow methodological approaches in this phase of the research study (Google+ was suggested by teachers who were voluntary participants in the third phase of the study).
- To have less distraction (it is easy to get distracted on Facebook or Twitter due to the number of posts and users).
- To create conversation opportunities, as interpersonal discussion is not an option on visual social media networks such as Instagram and Pinterest.
- To use the functionality of Google Apps that is available to teachers (Google+ is part of Google Apps).
- To use a platform which teachers are familiar with (Google+ is widely used by New Zealand schools).
- To mitigate social media barriers through utilizing a closed group for EE teachers.

6.2.3 Rationale for focusing on secondary school teachers

The study found some teachers feel isolated due to lack of educational support while they face challenges in order to integrate EE in school curricula. To overcome these challenges they need support and collaboration. Collaboration through social media could reduce isolation, especially for those teachers who are working in rural areas (Helen, interview). The findings that emerged from the questionnaire and interviews showed that EE teachers were looking for new ideas, resources and successful practices that could help them to engage with EE more effectively. However, access to these resources, ideas, other teachers and EE experts is a challenging task for those teachers who are in rural areas, as they do not have a community of teachers in their schools or even in the same area.

It also was indicated that EE teachers, especially in secondary school contexts, were not engaged in any established learning network (questionnaire & interview), particularly for

education for sustainability (EfS) Achievement Standards (Helen, Blake interviews). Phase two also found a lack of educational support and teacher professional learning among secondary teachers who engaged in the EfS Achievement Standards (Helen, Blake interviews). Building connections between teachers, and facilitating synchronous and asynchronous interaction, could help EE teachers at secondary level interact with peers and experts as well as access support and resources.

6.2.4 Rationale for establishing a closed community

A recurring idea in Phase one and Phase two findings was a sense amongst participants that learning through social media is helpful. However, the findings from Phases one and two showed that teachers were concerned about some challenges related to learning through social media, such as privacy (12/135 participants across the open ended questions in Phase one) and accuracy of information (10/135 participants across the open ended questions in Phase one). As social media can be “time-consuming” (T92) and a source of distraction, 35 teachers out of 176 questionnaire respondents expressed concern about spending too much time on social media for learning purposes, in response to a question about their concerns regarding professional learning through social media. In addition, some teachers claimed that they could not see a professional use for social media when “other aspects of social media can distract the user from focusing on the main reason for using it” (T139). For example, Facebook has the highest number of users for daily social interactions and entertainment. Despite the challenges, teachers believed that learning through social media is useful for EE teachers, if it operates through a user-friendly platform and straightforward network (Margaret, Karen, interviews) as a closed group only for teachers. Having a closed group of EE teachers would mitigate teachers’ challenges regarding learning through social media. When filling out the questionnaire a teacher commented, “some people put up trivial (or worse "off colour" things that are not related to the topic you are interested in e.g. EE or EfS). This doesn't happen ordinarily if it is a closed Facebook group though” (T164). Another teacher mentioned that a closed group “would be a good way to ask questions and/or advice from educators doing similar work but it would probably need to be Early Childhood /Primary/Secondary specific” (T31).

Therefore, for Phase three a learning community using Google+ was set up for secondary teachers and experts to support teachers delivering EfS Achievement Standards. The

learning community aimed to support teachers engaging with the standards through providing advice, answering questions, sharing resources and suggesting exemplars (see Section 3.3.2). This would help me to understand how this group of teachers engaged with a social media community for their professional learning in EE, which in turn would improve my understanding of teachers' perceptions and experiences of professional learning through social media in EE.

6.2.5 Section summary

This section presented the reasoning and justifications to support my decision regarding continuing the study into Phase three. The rationales behind the selection of the social media platform, participants and establishing a closed community were also clarified.

Findings from Phase one indicated that teachers were interested in joining a social media network for professional learning in EE in order to access support and resources more easily. However, findings showed that participants were concerned about some challenges regarding using social media for their learning. These findings were further supported by the interviewees in Phase two. In order to trial these findings and to have a better understanding of teachers' perceptions and experiences of professional learning through social media in EE, the study was planned to continue into a third phase.

To explore teachers' activities, wants and needs regarding learning through social media in EE, the study was planned to provide a professional learning opportunity and mitigate teachers' challenges by utilizing a user-friendly platform and having a closed community specifically for EE teachers. Although Facebook was chosen as teachers' preferred platform for learning, the third phase of the research used Google+ as a platform to establish a community of EE teachers. Google+ is part of Google Apps, which is currently used in New Zealand schools. As the most popular social media platform for professional learning and professional learning in EE, Google+ was selected to establish a learning community in the third phase of the study.

The study found that secondary school teachers feel isolated due to a lack of access to a community for learning to provide them with educational support and TPL. The closed learning community including secondary school teachers and EE experts would help secondary school teachers to overcome challenges regarding teaching EfS Achievements Standards. As highlighted, teachers were concerned about learning through social media.

In order to mitigate teachers' concerns about privacy and improve the accuracy of information on social media, a closed community of secondary school teachers was established through Google+.

6.3 The EEfS Community on Google+

The EEfS Community was established on Google+ to build connections between EE teachers and experts in New Zealand. Different elements of the EEfS Community are described in the following sections.

6.3.1 The Strategy

Considering the research findings and relevant literature and in line with the research approach, a strategy for the EEfS Community was designed (see Appendix E). Later, based on participants' suggestions, the initial strategy was modified and developed further (see Table 6.1). This strategy was a preliminary plan for the development of an interactive community based on teachers' perceptions. However, the exact work for the community could not be prescribed in advance, as all topics and activities were to be based on teachers' perspectives and suggestions. Accordingly, the plan was to set monthly and weekly strategies in consultation with the Community members.

As part of the strategy, it was intended that the EEfS Community would run throughout the school Term 1, 2018. The duration of the study was therefore planned for the beginning of November 2017 through to the end of April 2018. However, the possibility of keeping the community active beyond April 2018 was considered in the planning stage. The strategy which was used in the Community is shown in Table 6.1.

Table 6.1
The preliminary strategy for EEfS community

<i>Week</i>	<i>Topic(s)</i>	<i>Activities</i>	<i>Description of the administrator's activities</i>
1	Introduction	Encouragement	Asking everyone to introduce himself or herself and talk about their interests.
2	Feedback on introduction	Acknowledgement	Providing feedback to the members' introductory comments and their interests
3	Teachers' perception of EfS	Initiation	Finding out about the teachers' perceptions and understanding of EfS teaching and learning.
4	Feedback, discussion	Acknowledgement, Encouragement	Acknowledging teachers' comments, and encouraging teachers and experts to discuss further about EfS
5	Integrating EE in school curriculum	Question, answer, Discussion (webinar)	The ways in which knowledge, attitudes, and actions are related in addressing EfS, providing a plan for the Community
6	Feedback, follow-up	Initiation, Discussion Collaboration, Acknowledgement,	Encouraging teachers to add any viewpoints, inviting all members to contribute to this discussion by responding to some questions
7	Planning	Encouragement, collaboration, Initiation	Providing a summary of the webinar and teachers' posts on the Community to set future targets
8	Planning for summer	Encouragement, collaboration, Initiation	Organizing a webinar to plan for activities during summer

9	Suggested topic	Initiation	Opening the conversation by asking a question
10	Feedback, follow-up, and conclusion	Encouragement, Acknowledgement, discussion	Providing feedback to the members' posts, encouraging others to contribute to the discussion, and reviewing and collaborating in relation to the discussion
11	Expanding the community	Intervention	Asking all members to invite another EE teacher to the community
12	Teaching EfS achievement standards for 2018	Collaboration and discussion through the webinar	Organising webinars with experts
Future	Ongoing activities	Encouragement Acknowledgement Initiation	Asking new members to introduce themselves. Choosing topics and activities for each month based on teachers' suggestions, organising monthly webinars

As stated, the Community Strategy was a preliminary plan, as most of the activities were ongoing after adding new members. Also, in line with the methodological approach in this study, topics and activities for each month were chosen based on teachers' suggestions. The plan covered 12 weeks and the intention was to repeat some activities if the research participants decided to continue their involvement in the Google+ Community.

6.3.2 *The administrator*

As specified in Chapter 5, some participants believed social media “would be effective if well managed and administrated” (T83). In line with participants' suggestions to have “someone moderating and contributing learning” (T114) through social media, I played the role of administrator in the EEfS Community. Therefore, as part of the research strategy I was responsible for:

- Overseeing the community as an ongoing and collaborative learning community by facilitating weekly and monthly discussions with members.
- Using a variety of methods and activities to make the platform and discussion interesting, updated and in line with EfS standards.
- Encouraging participant collaboration toward learning.
- Making interventions to influence the direction of community debates on EfS subjects.
- Acknowledging member activities.
- Initiating communication and discussion in line with EfS topics, for example by asking questions, sharing news with the community or introducing a topic.
- Offering assistance, including how to use Google+, as well as accessing and updating information and resources.
- Providing an holistic strategy for the community.
- Arranging monthly webinars based on teachers' interests, wants and needs.
- Discussing with community members at the end of each month, in order to plan for the following month.

Some of the administrator's activities are shown in Table 6.2.

Table 6.2
The administrator's activities based on the Strategy

Date	The administrator role	The administrator's Post
25/10/17	Initiation, Introduction	Starting conversations with the community by asking members to introduce themselves and talk about their interests.
30/10/17	Feedback, Acknowledgement	Acknowledging the members' posts
9/11/17	Feedback, Acknowledgement	Acknowledging the members' posts Asking new members in particular to introduce her/himself
9/11/17	Initiation	Discussing issues around successful EfS by asking questions such as: What does successful EfS look like? What do you want the students to learn through EfS?z
15/11/17	Acknowledgement, Encouragement	Providing feedback and leading the discussion by asking questions or asking one of the experts to clarify the topic and issues around it, if any
4/12/17	Discussion through the Webinar	Organizing a webinar, concluding from the discussion
11/12/17	Follow-up	Sending the webinar recording
11/12/17	Planning	Providing a summary of the webinar's discussion, setting a strategy and future targets for the Community
6/2/18	Initiation	Opening the conversation by asking a question
14/2/18	Initiation	Opening the conversation by asking a question
3/3/18	Intervention	Encouraging members to invite other teachers to join the EEfS
12/3/18	Discussion through the Webinar	Announcement and Invitations

6.3.3 *The participants*

Participants in the EEfS Community could be seen as two groups. One group comprised all Community members and a second smaller group drawn from the Community were the research participants. This section provides a description of the participants in the EEfS Community, which includes all EEfS Community members and the research participants in Phase three.

6.3.3.1 *Description of the Community members*

As specified in the methodology chapter, participants in the EEfS Community comprised eight secondary school teachers who had indicated their interest in being part of the TPL community on Google+. Two of them (Helen and Blake) had taken part in previous phases and were engaged in the third phase from the planning stage. Later, when the community was established, six more teachers joined. Thus, the number of teachers in the EEfS Community was eight. Four teachers, however, did not contribute to any further activities. Consequently, there are no data to report in relation to them. Also, as highlighted in Chapter 3, those four teachers did not give their consent for the use of their data in this study. As a result, I do not refer to them as research participants. However, they remained part of the EEfS Community, which allows me to describe them as community members.

Also, as stated in the previous section, the plan was for the community to connect teachers with EE experts and possibly other people engaged in EE. Therefore, I invited two EE experts, and a Māori advisor to join our community. As highlighted in Chapter 3, as an outsider I did not have enough experience and knowledge of EE in the New Zealand education system. The experts' engagement in the community would help me to gain an insider's perspective. In line with the research findings, their participation would also provide support for teachers through the discussions and webinars.

An EE researcher joined the community and played a role as an EE expert. He is a member of the National Executive of the New Zealand Association for Environmental Education (NZAEE), and a Trustee of an environmental education NGO. He has been involved in EE for more than 15 years as a researcher and teacher educator. He has been teaching EE to first-year pre-service primary teachers and has a number of master's and doctoral research students studying EE with him. He has also conducted research and evaluation projects in this area. He participated in all webinars as the host and EE expert and led discussion on specific topics. His involvement in the Community, as well as in webinars, was one of the strengths which encouraged teachers to join.

Another EE expert in the EEfS Community had been teaching EE for over 14 years. She had also worked in local government as an Enviroschools regional coordinator and EE educator. She was also involved with the New Zealand Association for Environmental

Education (NZAEE). She contributed to the Community by answering questions and commenting on other members' posts. She also joined one of the webinars.

The Māori advisor was invited to become a member of the EEfS Community to share her knowledge of EE from a Māori perspective because Helen, one of the participants, was interested in the Māori worldview regarding the environment. Unfortunately, we did not use her knowledge and experience in our community directly. However, she advised me whenever I needed it.

A moderator from the New Zealand Qualifications Authority (NZQA) who was involved with the EfS Achievement Standards also joined the EEfS Community. It provided opportunities for teachers to ask questions regarding EfS Achievement Standards moderation and assessment. However, she/he did not directly participate in discussions and webinars.

6.3.3.2 Description of Phase three participants

As stated, four teachers who engaged in the community participated in Phase three by taking part in webinars and discussions as well as interviews. The following descriptions provide a brief description of the research participants in Phase three. As in Phase two, research participants are identified by their self-chosen pseudonyms.

Blake

Blake was involved throughout the research and took part in all three phases of the study. He was an experienced teacher of senior geography, environmental and outdoor education, junior social studies, and physical education. He was also a lead teacher of environmental studies and ICT in his school. He was not teaching EfS when he joined the community but had taught Level 2 and 3 EfS standards the previous 2 years, and had students working on various environmental projects. He was also involved with various environmental initiatives in his region.

He described his motivation for joining the community as “meeting other educators,” including EE experts and teachers, and wanted to collaborate with others who were teaching the EfS standards (Blake, interview 2). Except for one session, he attended all webinars and shared some valuable resources for the EEfS Community on Google+. For Blake, the Community was a place that provided opportunities to meet others and share

ideas about teaching EfS standards. He used Facebook for other subjects, such as geography and physical education, and also administrated some pages on Google+ as well as Facebook. Blake was interested in using social media for teacher collaboration in EE, as he believed social media were effective for teacher collaboration in other subjects but were lacking in EE.

Bruce Wayne

Bruce Wayne was our newest community member and had no experience in using social media for professional learning. He was a young teacher, teaching science, biology and sport in a school with a traditional education system. Environmental education in his school involved field trips and conservation activities. However, he was not teaching when he joined the Google+ EEfS community.

As a science teacher, he believed that integrating EfS in science was not particularly difficult but required interested, enthusiastic teachers. Therefore, he was attempting to encourage other teachers in his school to integrate EfS into the school curriculum. He was also involved in various volunteer activities related to EE.

In order to plan and set up the EfS programme for next year, he needed support and ideas from others and this motivated him to join the EEfS Community. He found collaboration with others through the EEfS Community useful and was attempting to use social media more in his teaching and learning.

Juno

Juno joined the EEfS Community soon after it was established. He was a science teacher at a small school and was involved in various environmental projects and activities. He also worked closely with the Department of Conservation and with NGOs. He did not have much experience with the EfS Standards, particularly with its assessments. His involvement in EE was mostly practical, incorporating EfS into student activities and for recognising their skills. Juno believed EfS Standards, and the NCEA associated with it, were essential elements in any school. He joined the EEfS Community in the hope that this initiative would produce solutions regarding the “use of social media and to make contact with a network of EE teachers involved in NCEA” (Juno, Google+).

Although he was not teaching any EfS Standards, Juno's motivation for joining the community was collaboration with EE experts, sharing contacts with anyone who needed advice, looking for collaborators, and bringing more teachers into the Community. Considering the limited number of EE teachers engaged in EfS Standards, he was interested in using social media for collaboration, as he believed this was a way for teachers to work together. He was involved in other online learning and teaching groups, including another learning community of teachers on Google+.

Helen

Helen took part in the previous phases of the research and was engaged in the EEfS Community from its planning phase. She was teaching maths and some EfS Standards when she joined the EEfS Community. She was interested in the social aspects of EE and being involved in community projects, as she believed there was huge potential for her school to do this. She was also interested in indigenous worldviews in general and Māori perspectives in particular.

Because of her convictions and her enthusiasm for EfS standards, Helen was motivated to collaborate with EE experts and teachers and develop wider connections in order to learn. An active member of the Community, Helen's involvement was not limited to participating in the webinars, but she also actively engaged in discussions, sharing resources and posting questions and answers. Her commitment to the EfS Standards led her to join the community in order to create opportunities for collaboration with experts and teachers. She believed that while face-to-face collaboration is limited by time and place, social media could facilitate TPL in EE.

6.3.4 Section summary

This section explored the third phase of the study from planning to implementation. For the third phase, the EEfS Community on Google+ was established to connect EE teachers and experts in New Zealand. To start the community, first a preliminary strategy based on the research findings was designed. The strategy was developed considering participants' suggestions. Duration, activities, participants, and the administrator's role were described in the strategy. As part of the strategy, it was mentioned that all topics and activities were to be based on participants' perspectives and suggestions. Therefore, activities were not prescribed in the strategy in advance.

Based on the previous finding, the community was administered. The administrator was responsible for encouraging members to engage in the community's activities. The community's administrator was also in charge of keeping the EEfS as an active collaborative learning community by providing opportunities for members for discussions and collaboration towards learning. Participants in the EEfS Community were eight secondary school teachers, two EE experts, and a Māori advisor. Four teachers did not engage in the community activities, whereas four of them did contribute in all or some activities as well as the interviews.

6.4 The activities of the EEfS Community

The EEfS Community aimed to provide collaborative learning opportunities for teachers who work or wish to work with EfS Achievement Standards. Drawing upon findings from previous phases, collaboration through the EEfS Community was defined and planned as ways to communicate, share and gain ideas and information, and gain access to resources in order to support EE teachers. As highlighted in Chapter 5, 39 (out of 135) participants answering open-ended questions mentioned receiving support as one of the advantages of TPL through social media. “Support” carries various meanings for these teachers, who had different expectations regarding receiving support through social media. While support for some participants meant direct assistance to “get quick feedback” (T147) and “sharing knowledge and experiences” (T38), others thought support could be indirect help through [providing direction towards ideas, inspiration, connecting with others, and sharing resources] (T67). Access to resources for teaching was identified as another use of social media for TPL in EE, identified by 18 (out of 135) participants in response to the questionnaire (open ended questions). Teachers were also interested to find out about events (T2) associated with EE teaching and learning.

The EEfS Community was designed to provide a collaborative learning environment and facilitate synchronous and asynchronous interactions between teachers and experts in different locations. Based upon the findings in the previous phases, synchronous activities were divided into several categories. This section describes the reasons and justification for organising a variety of activities for the EEfS Community as well as participants’ involvement in each activity.

6.4.1 *Synchronous activities*

As pointed out in Chapter 5, when considering learning through social media, some teachers were concerned about losing face-to-face interaction (38/135 of the participants), as they believed that “teaching is about knowing people, and relationships” (T52). Social media cannot always give teachers the same sense that develops in face-to-face interactive meetings that they are part of the community (T56). However, teachers were aware that providing face-to-face learning would be challenging, because of the limitations of time and place. To overcome such challenges, the adoption of video conferencing technology, such as Zoom, was proposed (Helen, interview 1).

Accordingly, as highlighted in the strategy, webinars were among the community activities I organised and ran. Based upon findings from Phases one and two, the aim of the webinars was to offer opportunities for EE teachers from different regions to hold synchronous interactions. Also, meeting other community members would provide teachers with a sense of belonging to a community or a group, allowing them to overcome their sense of isolation. In addition, having an expert to host webinars would enable teachers to ask questions and discuss any issues about integrating EfS into the school curriculum, teaching and assessment. It would also safeguard teachers’ privacy and promote the credibility of shared resources.

After discussion with the participants (Helen and Blake) in the initial meeting prior to Phase three, we decided to arrange the webinars with a focus on EfS achievement standards. To this end, we held five webinars to discuss EfS Achievement Standards. The first webinar, which was held at the end of 2017, combined a presentation regarding various aspects of the EfS Achievement Standards with a question and answer session. The webinar was not a one-way presentation by the instructor or speaker to the participants but consisted of synchronous two-way communication between the host and the participants.

Specific topics were discussed in other webinars from March to June, 2018. At the end of each webinar, the topic, date and time for the next webinar were confirmed with the participants. In order to inform community members and encourage them to join the webinar, the EEfS platform was used to post information about each webinar, such as topic, date and time, at least one week before each webinar (see Appendix J). Reminders

were also posted on the Google+ Community to encourage teachers and to elicit their engagement in the webinars a day prior to each.

Lasting about one hour, webinars were scheduled to fit the work day of Community members. Thus, we ran the webinars at 7 pm to make them accessible for teachers. Helen and Blake attended most of the webinars as they were determined to learn (Helen and Blake, interviews 2). Bruce attended only one of the webinars to share and gain ideas regarding his EfS programme and ways to integrate it into the school curricula and activities (Bruce Wayne, interview 2). Juno also joined one of the webinars, which was general in scope, but did not find the other webinars relevant to the practical aspects of EfS in which he was interested. Table 6.3 shows a summary of the scheduled webinars.

Table 6.3
Summary of the EEfS webinars' topics and discussions

Date & participants	Topic	Discussions and decision
4/12/17 Blake	The ways in which knowledge, attitudes, and actions are related in addressing EfS Providing a plan for the Community	The community's discussions will be around EfS standards. Teachers will choose the standards to discuss. The platform can be used to share teaching materials and exemplars.
12/03/18 Blake Helen Juno	Teaching EEfS Achievement Standards	Sharing ideas for teaching EfS Achievement Standards for 2018. Challenges for students to get University Entrance qualification from EfS standards. Assessing students' work.
9/04/18 Helen Blake	Discussion around EfS Achievement Standards	EfS Achievement Standards 2.1 and 3.1 on action-taking. Some examples and feedback from one of the NZQA moderator have been reviewed.
7/05/18 Helen Bruce	Exploring teaching achievement standards effectively	Methods to integrate EfS into other subjects The ways to put achievement standards from different subject areas together in order to teach effectively.
11/06/18 Helen Blake	The NCEA Review (this was a national review just underway) ⁴	Around soft skills and hard skills in EfS EEfS Assessment Reviewing the NCEA website "Have your say"

⁴ Details of the review can be found here <https://conversation.education.govt.nz/conversations/ncea-review/>

6.4.2 *Asynchronous activities*

As evident from the findings from previous phases, the purpose of the Community was to also offer asynchronous collaborative learning opportunities for teachers who are engaged with EfS Achievement Standards. To design and plan activities through the EEfS Community, participants' suggestions as well as their concerns were considered. As mentioned in Chapter 5, some participants perceived TPL through social media as time-consuming learning. Due to the number of posts and the quantity of unfocused information available, they felt they were not able to access relevant information or resources. To mitigate this concern, the EEfS platform was divided into the following categories: introduce yourself; questions and answers; events; discussions; links and resources; Achievement Standards level 2; and Achievement Standards level 3.

The selection of one category would only display the contents of the corresponding category. For example, if a teacher was only interested in finding resources, these could be found in the *Links and resources* category. The use of different categories to organise community activities would save teachers time, as they did not have to scroll down through entire posts to find relevant information or resources. As a result, teachers could access various types of support or resources very easily, saving time as they did so.

Introduce yourself

In the first category, Community members were asked to introduce themselves. This would provide participants with the opportunity to get to know other members of the learning network, which in turn could increase the level of trust amongst participants.

As stated in Chapter 5, findings from Phase one and two indicated that teachers were concerned about learning through social media because of potential privacy risks (12 participants) and possible poor online behaviour (5 participants). Teachers suggested that knowing who they were talking to would promote teachers' privacy and the accuracy of information on social media. Consequently, teachers would interact with other community members with less concern. Trust among participants would also motivate them to share resources and improve the quality and accuracy of information provided on the EEfS platform.

To this end, community members were asked to introduce themselves and talk about their background, interests and involvement with EE. After implementing this suggestion, all community members introduced themselves and shared their teaching biography in the *Introduce yourself* category. It was the only category that attracted the attention and engagement of all members.

Questions and discussions

Teachers saw value in the opportunity to ask questions through social media because the answers would be on demand (T28), timely (Blake, interview 1) and immediate (Karen, interview 1). In Phase one, when filling out the questionnaire a teacher commented, “If a teacher has any questions whatsoever regarding sustainability and EE, the answers can be found quickly and easily on social media” (T23). Another teacher mentioned that social media would be a good way to put questions to educators doing similar work, using a closed group (T31).

With regards to teachers’ perceptions, the EEfS Google+ Community, as a closed group, was intended to be “a forum for discussions, asking questions” (T47). Accordingly, as part of the EEfS Community activities, teachers were encouraged to ask questions and engage in community discussions. To start a discussion, I posted the first question, a broad, general one, for the EEfS Community on 9 November, 2017. The question opened up a discussion about what students learn through engaging with the EfS standards. After that, some members posted various more specific questions and most of these were answered by community members (Table 6.4).

Nevertheless, when Helen asked whether students can get literacy credits for AS91735 (World Views) and AS91736 (Biophysical Environment) standards, she did not receive any response. I emailed her query to an NCEA assessment moderator, seeking her advice. After 3 weeks, the answer was posted on the EEfS Google+ Community. As shown in Table 6.4, teachers were asked how they use today's world issues to help students understand EE. The question did not receive teachers’ attention and was left with no response. Also, Bruce Wayne posted his proposed course for Level 2 EfS on the EEfS Community page and sought feedback from other members. An NZQA moderator responded to his post. Table 6.4 provides an example of EEfS community discussions and questions.

Table 6.4

The community activities, Questions and Discussions

Date	Inquirer & Question	Respondent(s) & Answer(s)
9/11/17	Administrator: What does successful EfS look like? What do we want the students to learn through EfS?	<p>Blake: Knowledge, what sustainability means, what issues we are facing, possible actions that work towards solving these issues. Action, taking this knowledge to develop new values, and action</p> <p>Helen: Knowledge: The interdependence of all things, local issues are national and global issues, humans impact upon the environment, Māori perspectives</p> <p>Action: working together, listening to all perspectives, engaging with community members which exposes them to many viewpoints. By taking action students are empowered to make decisions.</p>
15/11/17	Juno: Do any of you know any teachers anywhere in NZ who are still teaching NCEA ES as a full subject?	<p>Blake: I did full level 2 last year and level 3 this year...trial by fire really...I haven't looked into whether any other schools are doing this. The moderator from NZQA has been my go to for moderation...</p> <p>Helen: I've been keen to do a whole course but haven't had anyone to talk to about this/gain support from /answer my questions. This year my three Y13 students pushed me to do the World Views paper and the Biophysical environment one, in addition to the personal action standard. Without support it feels risky, so I'm hoping I have set them up for success rather than failure. Connecting with others now feels wonderful!</p>
15/11/17	Juno: Why do we have so many acronyms for this topic? For example, NCEA uses EfS, DoC (Department of Conservation) uses EEfS	The expert: There have been endless debates about this, with good arguments made for each separate term. [Where I work, we refer to our practice as Environmental and Sustainability Education or ESE. This continues to foreground the E for environment but also focuses on sustainability, and removed the deterministic flavour of 'for' which some people find challenging in EfS or EEfS.
29/11/17	Helen: Can students get literacy credits for AS91735 (World Views) and AS91736 (Biophysical environment) and if so, what is the process?	A NZQA moderator: All of the level 2 and 3 internal EfS standards offer university entrance credits for 'reading' literacy but not 'writing' literacy. This is because evidence for all of these internal standards may be collected via alternative modes. For example, verbal and/or visual modes.

13/12/17	EE expert: What are people's drivers for action taking?	Juno: Environmental identity, enjoyment, social influence, and competition for time. Many students with a strong environmental identity seem to engage in all the environmental activities offered to them. There is also a group that only get involved in activities that are enjoyable to them, such as tramping, trapping, kiwi work, etc. There is a group that don't get involved due to negative social influence. One of the big factors is time demand - too many other things competing for their attention.
14/2/18	Administrator: How do you use today's world issues to help students understand EE? What kind of strategy has worked for you?	No response
11/4/18	<p>The expert: At Monday's webinar (9/4/18), a question was raised regarding the need to supply evidence of student work when asking for moderation. The experiences amongst the webinar attendees differed. I posed this question to a NZQA moderator.</p> <p>Helen: Does that mean that we can, for example, say we have seen the evidence / heard it verbally or do we need to send in the evidence - ie what does 'locate the evidence' mean?</p>	<p>The NZQA moderator: The most important thing for moderation is we can locate evidence that meets the descriptors in the achievement criteria.</p> <p>In most cases that is the students have clearly LINKED their work to aspects of sustainability! This is more important than log books!</p> <p>The expert: I believe it means that whatever you send to represent the students' work must clearly show the links to aspects of sustainability. In other words, the moderator must be able to see evidence of student understanding. If that is clearly shown in the student's report/folio/video etc, then the log book would not be required. I think this puts the onus on the student to clearly show those linkages through description, photos, timeline etc in what they submit.</p>
17/5/18	Bruce Wayne: seeking other members feedback on his proposed course for Level 2 EfS to choose between AS90811, AS90813, AS90810 or AS91734, AS90814, AS91733	<p>A NZQA moderator:</p> <p>Good luck Bruce, I would go for the personal action/reflection standard. You do need to scaffold it a bit but if your students have any motivation it is 6 very achievable credits with good opportunities to go for Merit and Excellence. The actual action is not the key bit and as long as you work them up on the aspects of sustainability you are sweet.</p>

Events

As discussed in Chapter 5, social media were considered a way to keep teachers updated about events (T2). Some participants saw the value of social media to spread news about events, seminars and activities related to EE. In line with the research findings and in order to support teachers, *Events* was the EEfS Google+ Community category where teachers would be informed of any relevant events. Teachers could utilise the EEfS Community to gain and share information regarding up-and-coming EE or TPL events in the events category.

The EEfS Google+ Community was not frequently used by community members to share news or information about EE seminars or any environmental events. Juno was the only community member who asked for and shared information about EE events. However, he did not post in the *Events* category, which was only used by the administrator to inform community members about webinar dates, times and topics.

Resources

The findings from Phases one and two showed that social media were used by some participants (18 participants) to access resources regarding learning and teaching EE. Chapter 5 illustrated that support for some teachers meant access to resources, including teaching tools (T40), assessment schedules (Helen, interview 1), lesson plans and term plans (Geoff, interview 1).

In order to provide support for EE teachers, one of the EEfS categories was designated for *Links and resources*, the category where teachers would have access to shared resources. However, an analysis of teachers' EEfS community activities showed that teachers did not post resources only under this category. Some were shared under other categories or even under other posts in comment sections.

As the community emphasis was on achievement standards, two more categories were specifically provided for Achievement Standards levels 2 and 3. Some resources were also shared under these categories. Table 6.5 summarises teachers' activities regarding the sharing of resources.

Table 6.5
The Community' activities, Resources

Date	Resource	By	Topic
24/10/17	Hyperlink	A member	EEfS, Strategy and Action Plan 2017–2021
6/12/17	Photos	Juno	Barriers to NCEA Environmental Sustainability in schools.
1/1/18	Hyperlink	Administrator	Human Impacts on Marine Species
25/2/18	Hyperlink	Helen	My produce bag, YouTube video
19/3/18	Abstract	The expert	Article on teaching EfS in a whole school approach
6/4/18	Shared drive	Blake	Students work EfS 2.1.
6/5/18	Shared drive	Blake	Student work EfS 3.1
9/4/18	Hyperlink	Blake	Strong sustainability for New Zealand
9/4/18	Exemplar	Administrator	Internal achievement standards, level 2
9/4/18	Exemplar	Helen	EfS assessment 3.1, Evaluate a personal action unit
9/4/18	Exemplar	Helen	EfS assessment 2.1, Evaluate a personal action unit
7/5/18	PDF	Administrator	EfS sample programme, Developing and integrated EfS

6.4.3 *Section summary*

I employed findings from previous phases to design synchronous and asynchronous activities for the EEfS Community. For synchronous collaboration, five webinars were run over the period of study by EE experts. Topics varied but centred on EfS achievement standards. The aim was to help teachers in different ways and support them. Webinars could give teachers the feeling of engagement in face-to-face interactive meetings and being part of a community. Also, the webinars would provide teachers with the opportunity to put questions to EE experts and would enable teachers to hold discussions with other teachers as well as giving access to shared resources. The forum would protect

teachers' privacy and ensure the credibility of shared resources because community members would know one another.

Asynchronous activities for the EEfS platform were divided into different categories to save teachers time when searching for specific information or resources. For the first category, participants were asked to introduce themselves in order to build trust among teachers and other members through developing a professional relationship with others. Two categories, *Questions and Answers* and *Discussions*, were intended to provide teachers with opportunities to share and gain information through asking questions and peer discussion. *Events* was the category for teachers to inform and be informed about environmental events or TPL updates. However, this category was not used by community members to share any applicable news or information. In addition to supporting EE teachers, a category was allocated for links and resources. Under this category, teachers would be able to share or find resources. Achievements Standards levels 2 and 3 were also provided as two separate categories to organise community discussions, resources and activities. However, an analysis of EEfS community activities showed that teachers did not post only under the defined categories.

6.5 Participants' perceptions and experiences of professional learning as EEfS Community members

This section reports the ways in which teachers perceived professional learning as EEfS community members through Google+ and the ways they participated in the community. Key findings in this section were gained from analysing and interpreting qualitative data gathered through interviews, observing the webinars, and analysing teachers' activities on Google+ as EEfS Community members. This section presents the community's strengths and weaknesses, and teachers' challenges regarding their professional learning through the Google+ Community as participants perceived and described them.

6.5.1 The Community's strengths

Collaboration and support opportunities were seen to be among the strengths of the EEfS Google+ Community. Participants perceived collaboration with other teachers and EE experts providing them with support when it was needed as some of the community's strengths. As highlighted in Chapter 5, collaboration and support for teachers meant ways

of communicating with EE teachers and experts, of sharing and gaining ideas, sharing information, and gaining access to resources. Access to support was the teachers' motivation to join the community in the first place and was also the reason motivating teachers to continue their involvement in the community's activities (Helen, Blake, Tim, Juno, interview 2). The EEfS Google+ Community was used by teachers to interact with peers and experts and to gain access to support and resources. For Blake "interacting with other educators, whether EE experts and/or teachers was the most satisfying thing about being a member of the EEfS Google+ Community (Blake, interview 2). Juno, on the other hand, declared that the opportunity of having EE experts answer questions was the best feature of the EEfS Google+ Community (Juno, interview 2).

Interviewees expressed clearly their understanding of support as an aspect of collaboration through the EEfS Community. For Bruce Wayne, support meant "knowing that if I have any questions or I need help, people (the community's members) are there who have done it before and they would help me out" (Bruce Wayne, interview 2). Support was mentioned by Helen as providing the opportunity to ask questions and giving access to resources. As she explained, "In the absence of Ministry [of Education] support, you can easily get to an expert (through the EEfS Community) to answer your questions" (Helen, interview 2).

In Helen's view, support also meant access to resources and material which could help in teaching EE and its assessment. Juno joined the EEfS Google+ Community hoping to gain access to resources when needed and found "shared resources regarding Standards 2.1 and 3.1 quite useful" (Juno, interview 2).

6.5.1.1 *Resources*

Table 6.5 above shows a list of the resources shared in the EEfS Google+ Community. In line with the findings from previous phases, resources such as term plans, teaching schedules or samples of assessments and student work and their valuations would support teachers. To this end, the EEfS Google+ Community aim was to enable convenient, ubiquitous, on-demand access to shared resources.

Concerning findings from previous phases, to help teachers engage in the EEfS Google+ Community, I shared a few examples for Achievement Standards, Level 2, as well as other resources. Helen, Blake and Juno also shared various resources in the EEfS Google+

Community. Blake shared his students' work regarding Achievement Standards 2.1 and 3.1. As highlighted in Helen's and Juno's interviews, teachers found shared resources regarding Standards 2.1 and 3.1 useful (Helen, Juno, interview 2). Helen's contribution related to Assessment Rubric 3.1 and 2.1. Juno, on the other hand, shared a spreadsheet which included a list of EfS teachers' names, the EfS Standards they teach, and their contact details. Since his list included teachers in only one region, he asked other community members to copy out details for teachers who teach EfS Standards from all around New Zealand. His aim was to connect teachers seeking to implement the same standard in different regions. In this way, those who teach the same standard could communicate, collaborate and support one another (Juno, interview 2).

The spreadsheet shared by Juno was regarded as useful for connecting teachers who focused on the same standard. In this regard, Helen asserted in her interview that among shared resources in the EEfS Community, "the things I have found really useful — and I used it — was the spreadsheet which includes teachers' names across a region and the EfS Standards that they were teaching" (see Table 6.5). Using the shared spreadsheet, Helen said: "I have contacted a teacher and she agreed with the marks that I had given" (Helen, interview 2).

On the other hand, sharing resources with other members was seen to be challenging for the teachers as they could not directly share a file (e.g., a PDF or Word file) within the EEfS Google+ Community. Some Community members did not know how to use Google Drive to share files on Google+. Also, the programme's inability to select sharing options contributed to Blake's frustration with using Google+ for his students' activities. In his interview, he explained that he had managed several Google+ pages to share his students' work.

At the moment, I am trying to do all our environmental portfolio stuff on a Google+ page and I want to put the kids' work there but I don't want the public to see the kids' work. I just want some of them as individuals or groups to see it. But the main problem is the sharing options. With the posts on Google+, it's either all private or all public and I find this difficult. Once my Google+ is set up as public, so everything is public. I want to have options for different posts in one page. You can do it in Facebook, for example make it private or public or only friends. That is my frustration with Google+ (Blake, interview 2).

6.5.1.2 *Webinars*

In interviews, which asked participants about their satisfaction with the community's activities, all four interviewees claimed that they were satisfied with the webinars and saw them as useful, interactive, and interesting. As mentioned earlier, webinars in this study involved teachers' interactions and communications. Through webinars, teachers were able to share ideas, ask questions and hold discussions regarding the webinar topic. Some resources for webinar topics and discussions were also shared (e.g., Exemplar for internal Achievement Standard EfS level 2, EfS 2.1, students' work).

For Juno, taking part in the webinars provided an "opportunity to have a face-to-face discussion with EE experts." He opined that when "teachers have many questions, it makes more sense to ask directly through a webinar rather than sending emails" (Juno, interview 2). Helen praised webinars for making it possible to meet other community members in the absence of the opportunity to meet them in person. "The webinars were great," she said, "because you feel that you have met a person. Meeting somebody (EE teachers or experts) in person is obviously ideal but webinars were good, second best if you like" (Helen, interview 2). "We are teaching very much in isolation," she continued. She endorsed webinars as a method to collaborate with others, particularly teachers and experts.

Regardless of teachers' positive perceptions about webinars, webinars did not attract many participants. The issue was raised in the interview with Blake. He commented on some of the reasons which he thought had hindered teachers' participation and involvement in webinars. The following is Blake's description, illustrating some of the factors which prevented teachers from engaging in webinars:

In webinars, as a teacher, you are dealing with general questions, such as "What does sustainability mean?" right down to the details of more specific topics, such as "What does an excellence in 2.1 look like?" If the topic is so broad and if that is not relevant to you, you are not going to, sort of, sit in it. For instance, if you have been teaching EfS for 5 years and the topic is what sustainability means, you do not feel that you need to attend.

On the other hand, when you [the researcher] have a small community and make the discussion and webinar topic so specific, for example, assessment in EfS standard 2.1, you narrow it down and if community

members have other commitments, the webinar comes further and further down the list because they do not need that specific topic. Then, they do not feel that they need to attend (Blake, interview 2).

This point was also acknowledged by Juno in his interview, when he remarked that “the first webinar was mainly general and it suited me, but the second one was specific to the assessment. As I am not doing assessment, it was not useful for me. Thus, I did not attend other webinars” (Juno, interview 2).

In line with the Community strategy, members were offered the option to watch recorded webinars posted on Google+. This was to provide them an opportunity to review the discussions multiple times, helping them revisit shared resources for reference and apply the contents as needed. However, as the interviewees admitted, participants did not allocate time for watching the recordings.

6.5.1.3 *Environmental education experts*

The research participants stressed the importance of access to EE experts as part of the EEfS Community. For Blake, “access to people like [the expert] was hugely valuable and that was part of the reason that I joined the community and engaged in webinars” (Blake, interview). When Helen was asked about the most satisfying aspect of being a member of the EEfS Google+ community, she replied: “Knowing that I had a means by which I could ask questions and find information. It would provide access to knowledge through connection with the wider scientific community.” She clarified this point further:

There is a lack of information due to the nature of EfS Standards. Because it is inquiry-based learning, you do not know which way you could go. In the absence of Ministry [of Education] support, you can easily get to an expert who answers the questions through the EEfS Community (Helen, interview 2)

The same view was expressed by Juno:

The most satisfying thing about being a member of the EEfS Google+ Community for me was the opportunity to have [the expert] to answer questions if we had any. Because there is a lack of expertise in the Standards. NZQA moderators do not even know much about EfS Standards. Also, getting in touch with them is not easy. So, having someone like [the expert] involved in the Standards is very useful. That

was probably the best thing about the EEfS Community (Juno, interview 2).

6.5.1.4 *Teachers' collaboration*

For participants, collaborative learning was aligned with the idea of interacting with other teachers. Peer interaction was seen as a way to share experiences which could support teachers in teaching the EfS Standards. Connections and the opportunity to put questions to teachers and experts through the EEfS Community were seen as motivation for some teachers to join and engage in the community. For example, Bruce Wayne's engagement in community activities followed from the fact that he was looking for ideas to confirm his proposed course for Level 2 EfS (see table 6.4). In his interview, he described his involvement:

I was designing a course for next year and I needed some help regarding which standard to choose and having a moderator to check my marking and that sort of stuff. Basically, having people to moderate and to check that I am on the right track was my main motivation to join the Google+ EEfS Community in the first place (Bruce Wayne, interview 2).

Blake related his motivation for joining the Google+ EEfS in his interview, as follows:

Collaboration with others and meeting other educators who are offering the standards was my motivation. In geography and other subjects, there is already a well-established community. So, having the same opportunities in EfS to meet teachers and hearing their ideas was the main motivation for me. (Blake, interview 2).

Drawing upon her experiences, Helen found joining the community encouraging, as it enabled her to meet and communicate with EE experts and other teachers. She stressed the importance and value of collaboration with other teachers to share ideas and experience (Helen, interview 2).

6.5.2 *Community weaknesses*

Along with strengths, a number of factors reflecting the EEfS Google+ Community's weaknesses were perceived and experienced by teachers as members of the EEfS Community. In this section, these factors are discussed.

6.5.2.1 *Closed community*

As highlighted previously, the purpose in maintaining a closed group was to increase teachers' privacy as well as the credibility of shared information and resources. Restricting the community to EfS teachers, on the other hand, was seen as one of the factors limiting teachers' engagement and the community's activities. Having a closed community restricted the number of members joining and this in turn limited the number of posts in the EEfS Google+ Community. Blake, for example, commented:

By having an open page or group, you will receive a number of posts every day, which is encouraging for members to check the platform more regularly. With a closed community including a small number of members, the platform does not get updated and its posts are limited. So teachers do not see any reason to check the platform frequently.

It is awesome communicating with EE teachers but sometimes it's nice to have an outsider as well. With an open community, you link teachers with people who are not necessarily teachers but experts or interested in the area. For example, EnviroSchool coordinators are a great source of knowledge regarding EfS. Other organisations such as the Sir Peter Blake Trust, Science Learning Hub, or other educators can add ideas into the Community. Therefore, teachers feel that they have more access to support and resources (Blake, interview 2).

The same view was expressed by Helen and Juno. For example, Helen remarked that "because we don't have many teachers to do EfS Standards, it could work better if we had an open community" (Helen, interview 2). Moreover, of the few teachers involved in EfS standards, she believed, only a fraction would engage in community activities. Thus, having an open community would improve community engagements and activities (Helen, interview 2).

6.5.2.2 *Number of teachers engaged in the community*

As noted before, the EEfS Community comprised eight teachers, with only four of them actively involved in the Community's activities. Participants suggested that having more teachers in the community would improve their collaboration as they would receive answers and suggestions regarding their questions and challenges. This was acknowledged by Helen in her interview. Expressing her view, she described her previous experience of collaborative learning using social media, as follows:

I used social media before for another subject. We had a professional learning course and we had a Facebook page with 63 members to support our learning. Asking questions and sharing resources worked very well as it was a wide community. Having a bigger number is great because if you post any questions, you will get a reply to it very quickly. You also might get several suggestions. While, with a few members in a community, sometimes conversations remain unsupported (Helen, interview 2)

Drawing upon his experiences, Blake also perceived that the limited number of community members weakened it. He stressed the importance and value of having more members to share resources and keep the community active and updated. Blake described his view:

I guess being a small community, it does not get regularly updated with resources. I am a member of a number of groups on Facebook. With more members, there is always a new post. It is encouraging and worthwhile for me to scroll through to find something that might take my interest.

As indicated in Section 6.2 (Community Strategy), one of the main strategies to improve the EEfS Community was to increase the number of teachers in it. To achieve this goal, community members were encouraged to introduce our community to other EE teachers. From the strategy, it was assumed that new members with similar interests would join and that those teachers would provide new resources and ideas, which in turn would improve teachers' collaboration through the EEfS Community. As described in Section 6.2, however, despite asking all members to invite another EE teacher to join, the community did not completely achieve this goal and remained with only a limited number of members.

When Juno was asked what he thought about teachers' limited engagement in the EEfS Community, he explained:

It seems that there is not a lot of EE teachers in the country and it seems to be getting less. If you get all of the EfS teachers in the community, still there are not many and still not a big group, and they're not overloading the community with questions (Juno, Interview 2).

This point was addressed in one of his posts as well:

In X region [where he was teaching] this year, there are only three schools teaching any EfS Standards, and all of them are only teaching a single standard each. A few years ago, we had a meeting of EfS teachers, with a

focus on moderation, and it looked like many more people were teaching it or planned to start teaching it (Juno, EEfS post, 15/11/17).

In Blake's view, apart from the limited number of teachers engaged with the EfS Standards, EfS is not a priority for teachers. Consequently, they do not invest their professional learning time in EE (Blake, interview 2). Helen thought encouraging teachers to engage in collaborative learning was difficult "because teachers do not have time" (Helen, interview Phase two).

6.5.3 Teachers' challenges and factors limiting their involvement

Participants experienced some challenges and described several factors affecting teachers' engagement in the Google+ EEfS Community. Drawing upon participants' perceptions, teachers' limiting factors and challenges in engaging in the EEfS Community are addressed in this section.

6.5.3.1 Time

Time was the main obstacle mentioned by participants regarding community engagement and was the reason why teachers did not engage in some of the EEfS activities and did not follow community posts. With a busy schedule, Juno's main challenge was finding the time to take part in the community (Juno, interview 2). In her interview, Helen was asked about the challenges for her engagement in the EEfS Google+ Community. Answering this question, she said that it was the "time involved in it and it is mostly because I don't have time" (Helen, interview 2). The following description illustrates Helen's view of the community and her difficulties with EEfS activities:

The community itself was very positive and very useful. However, it did involve time and that is something that I do not have a lot of. So, it was hard fitting it in to be part of all activities. That is possibly true for other people who came but they were not showing up. Consequently, we did not have too much input. But then again, I was determined to be involved and that was the reason I engaged in the EEfS Community (Helen, interview 2).

She believed lack of time could be a common challenge among teachers. As indicated in the previous section, Helen used the spreadsheet shared by Juno to contact another EE teacher. However, the teacher did not keep in touch with her, which might be due to lack of time as Helen pointed out in her interview:

I have contacted a teacher regarding my moderation and she agreed with the marks that I had given. She promised me that she would email me her moderation. But it never happened. I just think that is probably typical for teachers. Engaging teachers into collaboration is difficult because teachers do not have time. I think lack of time is a much bigger and wider problem for teachers than any other issues regarding professional learning (Helen, interview 2).

In previous phases, time and factors associated with it were recognised as major constraints hindering learning through social media. To clarify participants' views in regard to their engagement in the EEfS Community, they were asked if they preferred to engage in an online learning community as part of the work they did during school time, or if they preferred to learn outside school time. Although Blake valued learning during school time, he believed that it was difficult to manage:

As much as I would rather do it during the day, it is probably not possible. I probably do not have the opportunity during school time to engage in an online learning community. When I am in school, even when I am not teaching, there are meetings and conversations with other teachers. So, I do not have a big period of time that I am not interrupted (Blake, interview 2).

For him, uninterrupted time was in the evenings. As he put it, “after I have put my kids to bed, I tend to have uninterrupted time when I can engage with the community” (Blake, interview 2).

The same point was mentioned by Helen:

I don't get time uninterrupted at school. If a specific time was allocated to learning or one hour set aside only for the purpose of learning online that would work very well. But with my current schedule, I would prefer to involve in learning after school hours (Helen, interview 2).

When Bruce Wayne was asked about time, he explained that “it depends on teachers, how they manage their time.” He clarified his view further, as follows:

Personally, I go to work early and I leave early. I leave school as soon as it finishes, around 3.30 pm. Then I do some exercise, then usually in the evenings I spend an hour or more to learn and preparing students' activities. So, I don't mind learning after hours. But it could be because I have free time as I do not have children and do not have other stuff to do (Bruce Wayne, interview 2).

Juno also thought engaging in a learning community during school time would be very difficult unless it was during the non-contact period (Juno, interview 2).

6.5.3.2 *Teachers' priorities*

Teachers' engagement in the community was influenced by their priorities. It was noted that EfS is not a priority for teachers. They have other priorities which shape their professional learning in general, and professional learning in EE in particular. Blake explained why he thought only a few teachers were involved in the EEfS community:

Education for sustainability is not teachers' priority because for most teachers, EfS is the third or fourth subject that they teach. They might teach science, math or other subjects. So, they have professional learning in those subjects. Also, EfS is not standalone and that is part of the reasons which rank it down in terms of teachers' priorities. Teachers might have a class of ten kids and doing those standards as part of a science course, for example. Helen and myself, we teach full EfS standards and we are unique in this regard. (Blake, interview 2).

It was also mentioned that teachers do not have the same needs or set goals regarding professional learning as they are involved with different EfS Standards. It was stated that the community did not attract many members due to teachers' unfocused purposes. Juno, for example, joined the community as an active member but his engagement changed. He described the challenge which prevented him from being actively involved in the community, as follows:

I went to one of the sessions with the EE expert and that was interesting. But I am not teaching EfS this year. So, I don't really have any particular goals or things that I needed to find out through engaging with the community. It would be useful for me if I would have been teaching. I guess the challenges for me in that particular community was that it was quite driven towards assessment and I am not assessing this year (Juno, interview 2).

Blake emphasised that he had the same challenges regarding his involvement in the EEfS Community. "The challenges have been that I am not teaching specifically EfS at senior level and I don't know whether I will teach again next year or not. It would have been fantastic if it was two or three years ago when I was teaching both Level 2 and Level 3 Standards" (Blake, interview 2).

6.5.3.3 *Teachers' interest in face-to-face learning*

It was pointed out in Chapter 5 that it is important for EE teachers to maintain face-to-face interactions. Learning through social media, on the other hand, cannot provide teachers with the same experience. Consequently, some teachers were not interested in joining the EEfS Community. In this regard, Juno shared his view, based on his experience of teachers' engagements in a learning community using social media:

I do not know why, but people seem to be more motivated to get together face to face than online. I tried setting up a similar system [TPL using social media] for another group of teachers who wanted to be involved in TPL. But that didn't really flow at all. When I posted something there, no one responded. I found the most effective for my community was to get people face to face, have a meeting and share who is doing what assessments, then asking for their email to share resources. That gets good turn out, when people come together (Juno, interview 2).

Teachers' interest in face-to-face meetings was expressed by other EEfS Community members. Bruce Wayne suggested that as part of the community activities, "it would be good to physically meet people" (Bruce Wayne, interview 2). While Helen acknowledged the barriers for face-to-face learning, she ranked webinars as her second preferred method for collaboration. For her, these were very helpful because of the opportunity they gave for synchronous discussion, similar to the experience in a face-to-face meeting (Helen, interview 2).

6.5.3.4 *Teachers' social media preferences*

For participants in Phase one, joining a learning network was dependent on the type of platform, its ease of use, and their skills in using social media. Findings from Phases one and two showed that using a user-friendly platform would increase the use of social media for learning because no special skills are required. In this regard, findings from Phase three show that teachers' social media preferences influence their engagement in learning through social media, regardless of the platform's simplicity or ease of use. For Juno, recourse to Google+ as a platform for the EEfS Community worked well:

Although many high school subjects have a Facebook page, I do not use those pages as I am not a Facebook fan. For me, Google+ was very good and pretty straightforward. I use Google apps for everything. With Google+ Community, you get a little red dot coming in the corner to show

you have something to read, which is perfect. You can read it whenever you have time (Juno, interview 2).

Blake, on the other hand, believed Facebook would work better:

I think Google+ does everything it needs to do. But Facebook for me is the one-stop shop for everything. I still use Facebook every day and I receive updates from other communities. Facebook is where I go to get news as well. I don't think it is because that Facebook is more user friendly. It is just that I have been using it for 12 years and it is just a habit. I think it is the same for my generation and other teachers would be the same — that is just where we go. Also for teachers in our school, we use Facebook Messenger to communicate more socially and that is a kind of social thing as well. So Facebook kind of got everything when you sign up.

With Facebook, I don't get any notifications but I just automatically go. Because I am a member of a number of groups on Facebook, there is always something there and it's worthwhile for me scrolling through and stumbling upon something that might take my interest. In addition, some organisations' websites are linked to their Facebook page. For example, on the New Zealand Geographic Facebook page posts have links and if you click them, it takes you outside to the website where you get the details. I manage four pages on Facebook.

I tend to not visit Google+ regularly. I only use it if I get a notification via my email. And I guess being a small community, it doesn't get regularly updated with resources. Consequently, there is no regular notification. Another issue with Google+ is, the notifications come through email as well, with the links to the posts, and the main problem with that is I am in a work mind-set when I am going through emails, so I normally ignore Google+ notifications. But with Facebook, I don't even need notifications as I check Facebook regularly. (Blake, interview 2).

Bruce Wayne found Google+ easy to use. "Google+ was actually pretty useful because I always use Google services, such as Gmail and Google Classroom, and they link together. If it was another platform, it was another place which I have to go to; because it is part of Google apps, it's easier" (Bruce Wayne, interview 2). By looking at the pros and cons of Google+ compared with Facebook, Helen suggested it would help to have "a combination of two things like Facebook running alongside another platform, for example Google+" (Helen, interview 2).

6.5.3.5 *Lack of stimulation among Environmental education teachers*

The involvement in the community of more teachers, who enthusiastically participated in the activities, would encourage community members to actively engage in the activities. This point was mentioned in the interview with Juno. Although Juno was not teaching EfS, he joined the Community as an active member. However, it seemed that his motivation for engaging in the EEfS Google+ Community changed, because he did not participate in further discussions and activities. In his interview, he outlined his reasons, as follows:

My primary reason is a bit altruistic. I personally did not need to be part of the EEfS Community but my purpose was to get other teachers involved. I think it's important for others as well. I work with other teachers in X region, and I was trying to get them involved to have a wider group of people. So I guess at the start, I went in quite active just to try and get things going, but due to the lack of stimulation among other teachers, I kind of stopped. My intention was to have a wider group of teachers join the community and try to get a broader audience. It was nice to see people posting questions and other stuff but there was not enough engagement. I think the challenge would be trying to get other people engaged and get involved actively. I think a lot of people have a fixed system and it is going to take a lot to get them change what they are doing.

Blake stressed the importance of teachers' priorities to shape their engagements in professional learning. Teachers' amount of stimulation would be influenced by their priorities. He opined that "just like other minor subjects, EfS is not teachers' priority." Consequently, they did not engage in community activities (Blake, interview 2).

6.5.3.6 *Section summary*

Participants perceived the EEfS Community as beneficial for interacting with other teachers and EE experts. In interviews, which asked participants about their satisfaction with community activities and learning through the EEfS Google+ Community, all four interviewees considered that the Community boosted interaction between teachers as well as between teachers and experts. Teachers said that they found the following useful: the opportunity to talk to EE experts; support from other teachers; the opportunity to meet other members in order to have discussions and ask questions through webinars; resources shared by other participants; and opportunities to receive feedback and comments others made about their work.

Despite all the benefits of being a member of the EEfS Google+ Community, teachers' engagement in community activities was limited. Teaching was described as a demanding job that requires time management. Accordingly, time was seen as the main challenge for teachers to engage in community activities. Furthermore, as participants pointed out, teachers have diverse priorities which shape their involvement in the EEfS Community. Education for sustainability was not seen to be teachers' first priority and this may be the reason for their limited engagement in the community. It was also mentioned that because the community was closed and had a limited number of members, it did not receive regular posts and updates, which influenced participants' engagement. As a result, teachers were discouraged from active involvement in the community. It seems that the community's limitations, along with teachers' priorities, influenced teacher engagement. Teachers were not motivated enough to invest their valuable time and join the webinars or become actively involved in the community.

6.6 Participants' suggestions to improve teachers' engagement in the EEfS Community

As discussed in the previous section, participants signalled some weak factors in the EEfS Community. These weaknesses limited teachers' engagement in the community. In line with the research approach, participants were asked to recommend ways to improve teacher involvement in learning through the EEfS Community. To this end, teachers identified several strategies to make the best use of the EEfS Community for TPL in EE.

As noted by Helen, "a critical mass of numbers, possibly an open group" would improve teachers' engagement in the EEfS Community. "Because we don't have many teachers to do EfS," she explained, "therefore the Community could work better if it was open to everyone" (Helen, interview 2). Bruce Wayne shared a similar view. To maintain the community, he recommended that it be left open.

Based on his experience as a member of other online groups and communities, Blake suggested:

Make the EEfS Community open and more accessible. Then, invite others, such as stakeholders and organisations like Keep New Zealand Beautiful and other private organisations. We just need some of those organisations on board. Having people involved in EE somehow included would be

beneficial. They might have a website or pages on social media, when they post out, that would post in the community. Opening up to the organisations and having them involved would strengthen and enrich the EEfS Google+ Community. With a more open community, you can then link in people who are not necessarily teachers but they could be experts or simply interested in EE. It would be beneficial, as teachers feel like they're engaging with more people. So, they feel that they have more supports and connections (Blake, interview 2).

When Juno was asked to recommend methods to improve teacher involvement in the community, he replied: "If the group was run by an NZQA moderator who is in charge of assessment or one of the people who does the marking, it would be very popular. If it was somebody to answer questions (online or offline) rather than teachers always asking each other what might be right, you would have more success and more engagement" (Juno, interview 2).

Helen thought that "if it was some sort of support from the Enviroschools programme nationwide," more teachers would join the Community (Helen, interview 2). In order to engage teachers in the EEfS Community, Bruce Wayne's suggestions were: having professional help from someone like a facilitator, who is in charge of TPL in EE to post relevant articles and keep the community up-to-date; a national NZQA moderator to answer teachers' questions; or perhaps funding someone who would run the community as their job; leave it as an open community, so people can contact each other (Bruce Wayne, interview 2).

Blake believes that "the community requires someone who actively and regularly posts on and keeps it updated. However, when you moderate a page after trying sometimes and posting and there is no engagement, you would ask, 'What I am doing it for?'" (Blake, interview). For Bruce Wayne, meeting teachers engaged with the EfS Achievement Standards was effective. To this end he suggested: "It would be good to physically meet people. So, as part of the community, if there was some sort of map that places everybody on it so that everyone knew where everyone was, [this] could help to meet others physically" (Bruce Wayne, interview 2).

To be active members of the EEfS Community, participants perceived that they needed motivation, and finding time was a major challenge for teachers regarding their use of the EEfS Community. To overcome these factors, participants put forward a number of

strategies and suggestions, including opening the community not only to teachers but to any party interested in EE, inviting other teachers to join, seeking help from Enviroschools and NZQA, and providing an opportunity for teachers to meet other EfS teachers.

6.7 Chapter Summary

In order to obtain a better understanding of teachers' perceptions and experiences of professional learning through social media in EE, the study continued into the third phase. The third phase was designed to trial findings from Phases one and two through establishing a learning community on social media. It would provide an opportunity for me to understand how a group of EE teachers engage with a social media community for their professional learning in EE and how they would describe their experiences of learning through social media as a member of a learning community.

The study found a lot of interest in TPL through social media from participants in previous phases. Findings showed that learning collaboratively could inspire teachers in utilising social media for TPL in EE. Collaboration through social media was perceived by participants as ways to access support and resources through communication with colleagues, sharing and gaining ideas, information, and access updates. Therefore, findings from previous phases were employed to establish a learning community for EE teachers who were engaged in EfS achievement standards.

The Community was established to build connections between EE teachers and experts in New Zealand. In order to facilitate collaborative learning for EE teachers regarding teaching EfS Achievement Standards, both synchronous and asynchronous activities were designed as part of the community activities. To this end, five webinars were run from November 2017 through to July 2018 by EE experts. Different asynchronous activities also were designed to save teachers time when searching for specific information or resources. In order to build trust among teachers and other members, participants were asked to introduce themselves under the first category. Two categories, Questions and Answers and Discussions provided teachers with opportunities to share and gain information by asking questions and peer discussion. As teachers were interested to find out about environmental events, another category was provided to inform participants about environmental events or TPL updates. Also, a category was allocated for links and

resources to share or find resources. Achievements Standards levels 2 and 3 were provided as two separate categories in order to organise community discussions around Achievements Standards levels 2 and 3. However, participants did not use the defined categories to post their questions or resources.

Interaction with EE teachers and experts was seen as one of the satisfying features in the EEfS Google+ Community. Participants perceived synchronous interaction with EE teachers and experts and asynchronous support from other teachers as valuable. Therefore, interactive activities such as the webinars, questions and discussions as well as sharing resources and feedback were perceived to be beneficial for them.

Teachers, however, were not fully engaged in community activities as they were not motivated enough to spend their time. The reasons were described by the interviewees as a lack of time, diverse priorities, and lack of motivation due to the limited posts, updates and activities posted on the community. It was interpreted that some limitation associated with the community coupled with teachers' priorities shaped participants involvement in the community.

Participants claimed that they needed motivation and time to become actively engaged in the EEfS community. A number of strategies and suggestions were given by participants in order to improve teachers' involvement in the community such as: having an open community to attract more members including teachers and public, pursuing support and assistance from Enviroschools and NZQA, as well as providing face to face meeting opportunity for teachers.

The final chapter discusses these findings and addresses the research questions.

Chapter Seven:

Discussion, conclusions, and recommendations

This chapter presents a discussion of the research and its conclusions, together with research implications, limitations, and recommendations for further research. The focus of this chapter is to describe and explore the study findings within an interpretivist paradigm and also those reflected in current literature. Thus, the emphasis of the chapter is on discussing, interpreting and drawing conclusions from the findings to explain teachers' perceptions and experiences of teacher professional learning (TPL) through social media in environmental education (EE). A number of strategies which can be used in designing TPL through social media become evident as a result of analysing the findings from this research. This chapter therefore suggests some implications and recommendations to be considered in teacher professional learning in general, TPL in EE, and TPL through social media in particular.

7.1 Discussion

To achieve the research aims, as highlighted in Chapter 3 (Methodology and Methods), this study was designed in three phases. The first phase aimed to provide background information about teachers who are engaged in EE. To this end, as part of the questionnaire, the study explored demographic characteristics, teaching background, and the pattern of social media usage among teachers. Phase one also provided data regarding teachers' perceptions of TPL in EE as well as TPL through social media in EE. Interviews in Phase two were conducted based on the Phase one findings.

Findings from Phases one and two were used to explore teachers' perceptions and experiences of their professional learning through social media in EE. Phase three findings were based on data from a learning community made up of secondary school teachers. Findings from the three phases are used to answer the main research question regarding teachers' perceptions of professional learning through social media in EE.

This section is divided into five sub-sections, which are structured according to the research questions, as follows:

1. How do teachers, who are engaged in environmental education, use social media in general and in their professional learning in particular?

2. How do teachers, who are engaged in environmental education, perceive their professional learning in environmental education?
3. How do teachers, who are engaged in environmental education, perceive teacher professional learning through social media in environmental education?
4. How does a group of teachers, who are engaged in environmental education, become involved in a professional learning community through social media?
5. How does a group of teachers, who are engaged in a professional learning community, experience professional learning through social media in environmental education?

7.1.1 How do teachers, who are engaged in environmental education, use social media in general and in their professional learning in particular?

The study found that to engage with social media during or outside work hours, teachers mainly use laptop computers (63%) and mobile phones (44%). Specifically, the findings indicate that teachers prefer mobile phones and tablets/iPads for accessing social media when they are not at work, whereas they mainly use desktop computers for this purpose at work. These findings support the possibility that accessibility of social media across a range of devices may enhance their usefulness for learning (Gikas & Grant, 2013). Some restrictions or outright bans placed on social media in some schools have reduced teacher options for the use of personal devices to engage with social media. This is in keeping with literature that attests that institutional policies can restrict teachers' participation in social media (Bergl & Muntz, 2016; Davis, 2015).

The findings of this study indicate that different social media platforms are used by teachers for a variety of purposes. Teachers reported that their favourite platforms were Facebook (69%), followed by Google+ (40%) and YouTube (39%). The findings regarding Facebook and YouTube usage seem to be consistent with The Global Social Media Research summary, which states that with over 2.2 billion active users, Facebook has more users than all other social media platforms (Chaffey, 2019). At the time of writing (February 2019), Facebook was ranked as the most popular social network worldwide with 2.271 billion active users monthly (Statista, 2019). With 1.9 billion users, YouTube was reported as the second most popular social media platform (Statista, 2019). Although New Zealand statistics on teachers' social media usage patterns were not

available, it may be surmised that New Zealand teachers' use of Facebook and YouTube is in line with the worldwide pattern.

An unexpected finding was the relatively high use of Google+, as worldwide this has so far not been recognized as a popular social media platform. A possible explanation may be that the most popular social media platforms vary among different groups and demographics (Statista, 2019). Google+ was ranked as the fifth leading social network in New Zealand as of January 2018 (Statista, 2019). To date, little research on social media usage patterns among New Zealand teachers has been conducted, particularly with reference to groups of teachers who are engaged in EE. It is possible that the reported high use of Google+ is due to the widespread use of Google and Google apps in New Zealand schools (Ministry of Education, 2019b). As indicated by teachers many teachers have access to a Google+ account among their Google apps and the teachers in this study may have reported Google+ usage as they use Google apps in general, when responding to the question regarding their social media usage. This may have led to over-reporting of the actual use of Google+.

Although most teachers reported using Facebook for all social media purposes (69%), they mostly used YouTube for learning in general (70%) and Google+ (Google apps) for professional learning (57%), including specifically for EE (49%). The study found that YouTube is widely used for learning through watching uploaded videos. These findings agree with the those in a recent study by Moghavvemi, Sulaiman, Jaafar, and Kasem (2018), which indicated that many students use YouTube to seek, view, and learn information.

The reported use of Google+ for professional learning, including in EE, was respectively greater than for Facebook, YouTube, and other platforms and again may relate to the widespread use of Google apps in New Zealand schools. Teachers have a Google+ profile which is connected to their Google apps accounts. Through Google+, teachers can join a variety of learning communities, providing them with easy access to shared resources and information, which can be considered professional learning opportunities. Moreover, teachers reported preferring to keep their personal and professional use of social media separate (Sobaih et al., 2016). Facebook, for example, was popular for keeping up with friends or family, whereas Google+, linked to their Google accounts, was reportedly used

only for professional learning. Google+ therefore appeared to be used at work as an educational tool.

Teachers indicated that Facebook is their first choice when they were asked to identify social media platforms which they suggest would be useful for TPL in EE. There are several possible explanations for the teachers' choice of this platform to establish a professional learning network. This could be due to Facebook's ease of use (Sibona & Choi, 2012), and most teachers reported feeling comfortable using it. In addition, because of Facebook's popularity and its relatively long history of use, teachers are familiar with its functionality and are already connected with established learning groups. Facebook has been available online since 2004 (Facebook, 2019) and teachers may have invested time and effort in developing their own professional network through the platform. They may be reluctant to try new social media platforms for many reasons, including the time and effort they have already invested in Facebook, the number of their Facebook contacts, awareness of existing pages and groups, and a lack of familiarity with alternative social media platforms.

In spite of the possibility and popularity of using Twitter for general (Tur & Marín, 2014) and professional learning (Ross et al., 2015), the current study found that teachers engaged in EE made little use of Twitter for their professional learning in EE. This may relate to teachers' lack of knowledge in the use of Twitter. Teachers also reported that the more visual social media platforms, such as Instagram and Pinterest, are not widely used in their professional learning in EE. Pinterest, however, had more users among teacher participants than did Instagram and Twitter. A possible explanation for this may be that in Phase one the majority of questionnaire participants were primary school teachers (92/176). Pinterest has a range of ideas for primary school teachers. However, in contrast with a study by Collins and Halverson (2018) which shows substantial professional use of Pinterest among US teachers (67%), the use of Pinterest among this group of teachers in New Zealand is limited (44%).

The findings indicate that teachers' social media usage is not limited to one platform. Different platforms were reported to be used simultaneously for different purposes: personal use, social interaction, learning in general, professional learning, professional learning in EE, and professional connections. Teachers based their choice of platform on their awareness of the platforms available, and also on platform features and their ability

to fulfil their various needs. For example, while Facebook remained dominant for social interaction, YouTube was the favourite platform for learning in general, and Google+ was preferred for professional learning and professional EE learning. This finding is in agreement with those in a study by Zhao, Lampe, and Ellison (2016), which showed that people use a variety of social media platforms, depending on their various characteristics and advantages. Similarly, Brooks and Gibson (2012) found teachers do not confine their professional learning to a single method, technology or social media platform.

In the case of studies of social media use in TPL, researchers have focused on one specific platform or application in various contexts. To develop a full picture of what social media offers for general and professional learning, additional studies will be needed to discover how teachers incorporate multiple platforms into their learning. Due to the complexity of collaborative teacher learning through social media, there also needs to be more research to explore the uses of social media as modes of communication in order to support teachers' professional learning.

This study showed that the frequency of social media use for different purposes varied among teachers and was higher for social interactions than for general and professional learning. Teachers indicated that they use social media more frequently for keeping in touch with friends and family (Kolokytha, Loutrouki, Valsamidis, & Florou, 2015) than for networking with colleagues and learning. This is not particularly surprising, of course, because social media were originally developed and used for social interaction and communication (Johnson & Maddox, 2012). Despite being chiefly used as a communication tool to interact with friends and family, teachers clarified that they were aware of the benefits of social media for general and professional learning. Previous research findings (Meabon Bartow, 2014) have stated learning as an important factor for using social media among teachers. These findings gave support for the idea of providing a network of teachers and EE experts through social media to support teachers who are engaged in EE.

7.1.2 How do teachers, who are engaged in environmental education, perceive their professional learning in environmental education?

This study aimed to acquire a detailed understanding of teachers' perceptions of professional learning through social media in EE. To achieve this aim, preliminary

background information such as teachers' perspectives on EE as well as their experiences and perceptions of TPL methods in EE were first explored as a foundation for the study. This section discusses findings from teachers' perceptions and experiences regarding EE and TPL methods as well as the characteristics of effective TPL in EE.

7.1.2.1 Teachers' perspectives on environmental education

The findings of this study indicated that teachers regarded EE as an important aspect of the curriculum. As teachers in this study demonstrated, EE would improve students' knowledge of the environment and its associated issues. Environmental education would also equip students by enhancing their values and skills related to the environment which guide sociality toward sustainability. Teachers' views on EE are in line with the *Guidelines for Environmental Education in New Zealand Schools* (Ministry of Education, 1999). As indicated in the *Guidelines*, EE is a process which incorporates raising awareness of the need to take action on environmental issues and toward sustainability. In accord with the New Zealand school curriculum, teachers also perceive EE as including multidisciplinary teaching and learning approaches (Ministry of Education, 2007).

The findings of this study showed that teachers saw EE as education for students' future. These findings align with research by N. S. Evans et al. (2012), which indicated that pre-service teachers in Australia described EE as a means to developing skills to equip students for their future. This study, however, showed that teachers recognised a lack of emphasis about EE in New Zealand schools. This finding is in agreement with early research in EE by Littledyke (1997), who argued that while many teachers consider EE an important part of the curriculum which needs to be included in teaching, EE is not reflected in their teaching practice.

7.1.2.2 Teachers' perceptions and experiences regarding teacher professional learning methods and teacher professional learning in Environmental education

Most teachers stated that they engaged in some form of professional learning. While most (n=150/161) made a practice of informal face-to-face discussions with colleagues, they had less experience of a learning network through social media (n=99). According to the interviewees in this study, this was because there is no established network for TPL in EE. Teachers also felt they had insufficient knowledge and skills to use social media for their professional learning in EE. This is an important finding but cannot be extrapolated

to all subjects and teachers, due to the lack of statistical information about the number of active social media network users in different subjects.

Based on teachers' experiences, *visiting other schools* is the most effective TPL method in EE. Visiting other schools and observing other teachers' work and activities helps in gaining new ideas and learning to overcome challenges in integrating EE activities into the school curriculum. This is aligned with the study conducted by Admiraal et al. (2016) and a study by Cameron et al. (2013) which identified usefulness of observing other teachers' activities and practice to improve teaching practice.

Asking EE experts questions and discussions with them in any setting was found to be the teachers' next most preferred TPL method in EE. As teachers clarified, in view of a lack of information regarding teaching EE, the value of communication with EE experts is that teachers are able to ask questions. This is aligned with the previous studies in TPL which emphasised the effectiveness of support from experts in TPL in order to overcome teaching challenges (Darling-Hammond & McLaughlin, 2011; Darling-Hammond et al., 2009).

The majority of teachers claimed that they experience self-learning (151/161 participants) in EE. However, self-learning is not teachers' preferred TPL method and was considered least effective in improving teachers' EE knowledge and skills. There are several possible explanations why self-learning is not favoured. First, self-learning may be variously understood, based on teachers' experiences. Secondly, teachers may face difficulty with self-learning in the EE context and therefore perceive it as inadequate to improve their knowledge and practice in EE. Thirdly, self-learning is characterised as flexible, enabling individuals to learn at their own pace and convenience. However, unstructured self-learning is not teachers' favourite TPL method since they generally struggle with the pressure of time constraints. In contrast, teachers appreciate TPL when it is included in formal, structured settings, such as seminars or workshops. Fourthly, teachers attempting self-learning may experience a lack of support and collaboration from peers or experts. Self-learning, on the other hand, means putting more pressure and responsibility on the teacher to manage their own professional learning without any support.

The findings in this study showed that generally, teachers look for support and feedback from their colleagues or EE experts when it comes to professional learning in EE. These

findings are aligned with previous studies which highlighted the value of collaborative TPL (Cameron et al., 2013; Darling-Hammond et al., 2009; Mansfield & Thompson, 2017; Opfer & Pedder, 2011). As indicated by interviewees, collegial support is a source of reinforcement and motivation for them. This aligns with the study conducted by Beach (2012) which characterised effective TPL as collaborative. Peer collaboration helps teachers to continually develop their knowledge (Kuusisaari, 2014) and reduce feelings of isolation. Beach's findings are consistent with research by Opfer and Pedder (2011), which indicated that collaboration can motivate teachers in the process of learning and applying what they learn to their teaching practice. In this aspect, teachers' perceptions can be interpreted by social constructivism. Social constructivism views learning as an active social process which occurs in social groups. Professional learning therefore is occurred through interactions and communications (Vygotsky, 1978).

This study has found that teachers perceive formal face-to-face courses or workshops to be effective TPL methods for improving their EE knowledge and skills. These findings are consistent with a research report by the New Zealand Post Primary Teachers' Association (NZPPTA), which indicated that teachers value one-off workshop opportunities to enhance their knowledge in particular areas (NZPPTA, 2013). This finding differs from some previous studies, however, which have deemed formal face-to-face TPL (particularly one-off experiences) to be ineffective (Mansfield & Thompson, 2017; Opfer & Pedder, 2011; Timperley et al., 2007).

This rather contradictory finding may be due to the study context. New Zealand teachers' experiences of formal TPL may be different from those of overseas teachers. Formal TPL is diverse and dependent on the circumstances in which it is undertaken. As Timperley et al. (2007, p. xxv) emphasised "what is known to be effective is not always what is practised". Formal TPL such as conferences and workshops are popular among New Zealand teachers (NZPPTA, 2013). Some formal TPL in the New Zealand context may provide learning that has an impact on student outcomes. Also, teachers' experiences of professional learning vary, depending on the subject area. For example, a teacher may find visiting a school effective for professional learning in EE but the same teacher may not find this approach useful for maths or English. It should be noted again that the study's target population consisted of teachers engaged in EE. As highlighted by teachers, EE is a practical subject, which involves hands-on activities. Therefore, teachers believed that

real-life interactions, such as workshops or visiting schools, are effective to improve teachers' knowledge and enhance their teaching practice in EE.

Consistent with the literature, findings from this study indicate that improving students' learning is the most important aim for professional learning in EE. Previous studies on TPL have also emphasized its importance for student learning (Admiraal et al., 2016; Darling-Hammond et al., 2009; Desimone, 2009; Labone & Long, 2016; Lumpe, Czerniak, Haney, & Beltyukova, 2012; Timperley et al., 2007; Wayne et al., 2008). The teachers in this study reported specific features of teacher professional learning that were very important to them. While all these features afforded by social media were considered essential for TPL in EE, some aspects, such as a focus on improving student learning and being linked to the curriculum, were rated more highly than other aspects, such as being free, available and flexible. This can be explained in part by teachers' commitment to student learning. It seems that teachers value TPL methods which promote student learning more than any aspects that serve their own convenience. To a great extent, these findings are consistent with other research which has characterized effective TPL as collaborative, intensive, sustainable, ongoing, focused on student learning, and attached to teaching practice (Beach, 2012; Kuusisaari, 2014; Liu et al., 2016; Opfer & Pedder, 2011; Timperley et al., 2007). It can be argued that teachers consider EE an important aspect of education for improving environmental knowledge, values and skills among students toward sustainability. Consequently, student achievement was perceived as the most important TPL goal in EE.

Another compelling finding is that teachers perceived a lack of educational support for teacher professional learning, particularly at the secondary level. In order to fill this gap, secondary school teachers prefer TPL opportunities in EE with a focus on achieving Education for Sustainability Achievement Standards, making provision for discussion and putting questions about NCEA (National Certificate of Educational Achievement) and to NZQA (New Zealand Qualifications Authority) or EE experts. This finding is in agreement with the NZPPTA report (NZPPTA, 2013). Secondary school teachers are also interested in workshops which promote collaboration among teachers.

Teachers identified collaboration as a key feature in TPL in EE. Collaboration is desired as it helps to improve pedagogical skills and content knowledge among teachers and this in turn enhances their teaching practice in EE. These findings are aligned with previous

studies which highlighted the benefits of collaborative TPL (Cameron et al., 2013; Darling-Hammond et al., 2009; Opfer & Pedder, 2011). As explained by teachers, communication and discussion with peers or EE experts, observation of other teachers and school activities, sharing resources and providing the structure to use them, and giving access to exemplars are beneficial for them. Collaboration also encourages teachers to integrate EE into school activities. As teachers stated, collaboration at the secondary level is beneficial as it helps teachers to understand the Education for Sustainability Achievement Standards, understanding of diverse methods to deliver the Standards and helps teachers to assess their work.

7.1.3 How do teachers, who are engaged in environmental education, perceive teacher professional learning through social media in environmental education?

This study showed that teachers perceived the potential of social media for TPL in EE is high (68%/151). This finding is in line with the outcomes of previous studies addressing learning through social media (Bexheti, Ismaili, & Cico, 2014; Carpenter, 2014; Davis, 2015; Holmes et al., 2013; Ross et al., 2015; Trust et al., 2016). The majority of teachers in the current study identified social media had significant value for TPL in EE to provide peer support and collaboration opportunities (Greenhow et al., 2018). Teachers reported that they perceived social media to be beneficial for accessing peer support, including instrumental support, informational support, and emotional support (House et al., 1988). The literature discussed in Chapter Two clearly outlined the same values had been identified in studies addressing social media for learning (Carpenter, 2014; Davis, 2015; Holmes et al., 2013; Ross et al., 2015; Trust et al., 2016).

As the findings from this study show, social media was seen to be effective for teacher collaboration when accessing direct support in terms of ideas, updates, and resources for teaching EE and obtaining indirect support through guiding them toward the right direction and information. These findings are aligned with research by Davis (2015) which indicated that teachers used social media for collaboration to share knowledge and resources. As found in Davis' study, through social media, teachers also experienced emotional support from colleagues. Similarly, findings from the current study highlighted that peer support and collaboration involves emotional support and encouragement from peers. This is in agreement with a study conducted by Greenhow et al. (2018) who

reviewed the literature on the ways social media are perceived and used by K-12 teachers and identified emotional support as an affordance of social media-based TPL.

This study's findings showed that teachers' expectations regarding support and collaboration were inconsistent. In Phase one and two, teachers indicated their various needs and expectations regarding receiving support, ideas, and collaboration through social media. Findings from Phase three, however, showed less inconsistency in teachers' perceptions regarding support and collaboration. It can be argued that support and professional learning were signified differently for teachers based on the educational setting in which they taught. This is in line with a study by Timperley et al. (2007) which recognised diverse of TPL needs within different groups of teachers. It should be noted that Phase one participants in this study were from different educational setting, whereas Phase three participants were all secondary school teachers.

Teachers reported that they perceived learning through social media to be beneficial due to its availability, flexibility, time-efficiency and cost-effectiveness. These findings are consistent with those of other studies which suggest that social media can provide access to cost-effective and on-demand support and resources (Davis, 2015), anytime-anywhere learning opportunities (Ross et al., 2015; Trust et al., 2016), just-in-time learning (Greenhow et al., 2018) and are a way to overcome time and financial challenges associated with TPL (Goodyear, Casey, & Kirk, 2014). The teachers in this study have also identified the value of social media in reducing teachers' isolation through connecting and networking with other educators. This is in line with a study by Ross et al. (2015) who stated that social media has the potential to be used in order to “transform teachers' isolation to learning opportunities” (p. 58).

As the findings from this study show, teachers who work in area schools or those teachers who did not have a community of teachers in EE in their school demonstrated more interests in learning through social media. As has been argued by Davis (2015) this finding indicates social media can provide support for teachers who do not have access to face to face collaboration and support opportunities. These findings are also, to some extent, in line with Alhassan (2016) findings regarding mobile learning among students. Alhassan's study stated that students who lived far from the university are more interested in mobile learning opportunities. Social media is also considered a learning approach *for the future*, which Beetham and Sharpe (2013) see as strengthening the relationship

between pedagogy and technology. It would therefore appear that TPL through social media could improve teachers' digital literacy, which is in line with 21st century learning goals (McLoughlin, 2011).

The teachers in this study expressed their concerns about some drawbacks and challenges in relation to learning through social media. Their main concern was time, which is in keeping with the literature that attests time is one of the main difficulties or challenges regarding learning through social media (Bexheti et al., 2014; Davis, 2015; Schoenebeck, 2014; Sobaih et al., 2016). A lack of time has also consistently been recognised as a challenge for TPL in general (Timperley et al., 2007) and TPL through social media in particular (Chen & Bryer, 2012; Davis, 2015; Greenhow et al., 2018; Zhang, Liu, Chen, Wang, & Huang, 2017).

More specifically, teachers in this study indicated learning through social media was time-consuming because they had to find information from different pages and resources. In its essence, social media can be overwhelming with information overload and can be a source of distraction when it is not focused on a teacher's interests and needs. This is in keeping with Davis's study (Davis, 2015) that indicated teachers felt overwhelmed by the constant time expenditure and untrustworthy information on social media. This has also been highlighted as a weakness of social media in a study that discussed the findings of 132 papers on social media use for different purposes (Kapoor et al., 2018).

Teachers' concerns were not only related to a lack of time to engage in learning through social media, but were also related to devoting their personal time to professional learning. A similar finding was reported in Davis's study (2015) which concluded that "teachers who do not have the option or do not feel supported in using online venues during the school day may have difficulty balancing work and personal commitments" (Davis, 2015, p. 1556). In the present study, teachers felt discouraged from learning through social media, as it required using digital devices. After working with technology and looking at a screen all day, some teachers were not keen to spend more time online. However, these findings were limited to this study and similar findings were not reported in other studies.

Similar to the findings of a study by Schoenebeck (2014, p. 773), in the current study teachers were concerned about the trade-offs between spending time on social media (in the virtual world) and spending time in "real life". Some teachers reported that they had

no interest in learning through social media as they assumed that they might lose intimate human contact and interactions in the real world. Teachers also expressed that another reason for their apathy towards using social media for their professional learning in EE, was that they perceived a conflict between EE, which is a practical subject, and learning through social media. It seems possible that teachers' lack of experience in professional learning through social media, particularly in EE, led them to this conclusion.

It could be argued that the perception among teachers that EE is primarily a practical subject is evidence of their unfamiliarity with the underlying principles of EE (Bolstad, 2005). Although EE is a multidisciplinary approach, which should be integrated into all eight learning areas (Ministry of Education, 2007), it is practiced (particularly in early childhood and primary schools) as a practical subject involving hands-on activities, such as gardening and recycling. This misconception is consistent with research by Bolstad et al. (2015), which identified that the *action oriented* aspect of EE (in form of hands on activities) has been the most widely accepted and promoted characteristics of EE in New Zealand schools, whereas being action oriented is only one aspect of EE .

As discussed in Section 5.3.4, teachers reported a number of concerns regarding their privacy and confidentiality while learning through social media. This is in keeping with the literature, which has identified privacy as a barrier to using social media for teaching and learning (Bexheti et al., 2014; Chen & Bryer, 2012; Sobaih et al., 2016). Moreover a few teachers have stated that social media is banned or limited in some schools, which constrains their ability to use it for TPL. This is in accordance with Davis's study, which identified schools' policies as a technological drawback when using Twitter for TPL (Davis, 2015).

Teachers indicated that they perceived several difficulties and barriers when seeking to incorporate social media into their professional learning. As well as a lack of interest in learning through social media, teachers also suggested social media may be employed more successfully in EE when it is used in blended TPL. As shown in Chapter 5, 65% of Phase one participants were interested in a combination of face-to-face learning and learning through social media. These findings confirm previous studies that have stated that social media could be used as a backchannel to support TPL (Ross et al., 2015) or a blended learning approach (Brooks & Gibson, 2012).

These findings are consistent with research by Arkorful and Abaidoo (2015) which investigated the effectiveness of e-learning in tertiary education. In a review of the literature, they remarked on the absence of personal interaction as a disadvantage for e-learning, due to a lack of “clarifications, explanations, and interpretations” (p. 35). To make use of e-learning, therefore, learners need strong motivation and time management skills. Arkorful and Abaidoo (2015) also claimed that applying e-learning in disciplines that require practical activities might be more difficult than in the social sciences.

Regardless of all the challenges and limitations, teachers stated that the importance and advantages of TPL through social media cannot be ignored. They found significant value in social media for their professional learning (Bexheti et al., 2014) and consequently a very high percentage of teachers reported that they would consider using social media for TPL in EE (80.5%). However, the study found a sense amongst teachers that social media would support their professional learning under some conditions and not others (see chapter 5). These conditions and teachers’ suggestions were considered when establishing a Google+ Community for TPL in Phase three. In other words, I used the research findings from Phase one and two to mitigate teachers’ concerns regarding learning through social media, in order to explore how a group of teachers engage, experience and perceive TPL through social media in EE. The community members were secondary school teachers who were engaged in EfS Achievement Standards and EE experts. The next two questions address their engagement in TPL through the EEfS Google+ Community as well as their experience of professional learning through the Google+ Community.

7.1.4 How does a group of teachers, who are engaged in environmental education, become involved in a professional learning community through social media?

As discussed in Section 3.5.3, for the third Phase of the study my intention was to provide an online learning community to facilitate TPL for secondary teachers who were engaged in EfS Achievement Standards. This intervention was informed by teachers’ needs, wants and suggestions and attempted to address some of the limitations or challenges regarding learning through social media that they had identified. I sought to understand the way teachers perceive and experience TPL in EE through social media. However, whilst in the first and second phases of the study teachers showed their interest and enthusiasm in joining a social media network for TPL in EE, the community did not attract many members.

Low participation may be associated with differences in the distribution of respondents by educational setting in Phase one compare to Phase three. In Phase one, the respondents were mainly from primary (92/176) and early childhood (54/176) settings, with only 15 secondary school teachers participating. As explained in Section 4.1.2, this distribution was anticipated because teachers who participate in the Enviroschools Programme are primarily from early childhood and primary educational settings (Enviroschools, 2015, 2016). Phase three, however, was designed to provide support and professional learning for secondary school teachers, as they had indicated a greater need for TPL.

Teachers' inconsistent interest in joining a TPL community between Phase one and three and their limited engagement in the EEfS Google+ Community in Phase three could also be explained by the small number of teachers who are involved in teaching EfS Achievement Standards. The learning community in Phase three was designed to support secondary school teachers who were engaged in teaching and assessing EfS Achievement Standards (Section 3.5.3). However, as indicated by the research participants from their knowledge, there are not many secondary school teachers who are engaged in using the EfS Achievement Standards in New Zealand (although the exact number is not publically available). From this relatively small pool, only a limited number of teachers joined the EEfS Google+ Community.

Four of the teachers who joined the community did not contribute to the community's activities at all. In addition, while the other four teachers acknowledged the advantages and effectiveness of the EEfS Google+ Community and perceived advantages in being involved in the EEfS Google+ Community, they did not fully engage in the Community activities either. This finding confirms the results of previous research which has demonstrated inconsistency between teachers' interest and willingness to use social media for their professional learning and their actual engagement and usage of it. A research by Zhang et al. (2017) found limited interaction in teachers' online learning whilst they showed their positive attitudes toward the online collaborative learning. As Zhang et al. (2017) concluded, lack of time might be one of the main barriers which affect teachers' engagement in online interaction and collaboration for learning. It is also similar to findings from a study by Selwyn (2012) which shows a limited number of participants chose to engage in online discussion forums.

It also can be argued that the Community did not attract many members due to teachers' different priorities. Since the teachers were engaged in different EfS Achievement Standards, they had diverse needs. Timperley et al. (2007) recognised that diverse professional learning needs within different groups of teachers depends on their teaching context. Accordingly, teachers in this study believed that support should be based on their specific needs related to Standards they were teaching and assessing. They wanted resources and support to be readily available and accessible whenever they need to ask questions and discuss issues in relation to their learning and teaching (Taylor & McQuiggan, 2008). To recap, although teachers reported a high intention to join a learning community through social media in Phase one, their actual cooperation and engagement was low in Phase three. Teachers' engagement in the community showed that TPL through social media is a complex process that is more difficult to attain than the study findings in Phases one and two showed.

Despite the limited number of members, the Community was utilized by teachers for collaborative learning. Four of the teachers who were involved in the community were engaged in EfS Achievement Standards in their current work, used to work with them or were planning to work with them in the future. The Community provided support and collaborative learning opportunities for these teachers through communication with other teachers and experts, and enabled them to share and gain ideas and information, and access to resources.

In order to explain TPL through the EEfS Google+ Community, the theory of situated learning is useful. Based on this theory, a learning community is identified by its specific characteristics, the domain, the community, and the practice (Lave & Wenger, 1991). Teachers who joined the EEfS Google+ Community were passionate and concerned about EfS Achievement Standards (the domain). Their involvement in the community included learning, discussion, cooperation, sharing of information, and helping each other based on their community connection (the community). Lastly, it seemed possible that teachers' knowledge and skills were developed through interaction and collaboration with other community members (the practice). It is therefore evident that a learning community had been established through the use of social media.

As teachers' engagement in the EEfS Google+ Community occurred online, it is consistent with the idea of a virtual learning community (vLC). Ostashewski and Reid

(2010) have identified the key features of vLC are engagement, discussion, collaboration, peer support and sharing of information. These features were evident in the EEfS Google+ Community which indicates a vLC had been successfully established.

As outlined in Chapter 6, teachers perceived a number of strengths, challenges, and limitations regarding learning through the EEfS Google+ Community. The next section addresses these factors based on their experiences as community members.

7.1.5 How does a group of teachers, who are engaged in a professional learning community, experience professional learning through social media in environmental education?

Findings from Phase three indicated that teachers perceived synchronous and asynchronous collaboration and interaction as strengths of TPL through the EEfS Google+ Community. Consistent with the previous phases, collaboration was seen to be important in order to receive support, exchange ideas, and access to shared resources. In this study, teachers' learning was influenced by more experienced teachers or experts through the process of *scaffolding* consistent with constructivist perspectives on learning (Bruner, 1960; Ng, 2015).

Teachers reported that they were satisfied with their interaction with others through the EEfS Google+ Community. This was not limited to interaction with teachers, but included engaging with EE experts and other educators with whom they had the same interests and passions. As emphasised in Vygotsky's theory (1978), collaboration is a key concept in learning. In line with social constructivism, collaboration was the main aspect evident in the EEfS Google+ Community. Collaboration occurred between teachers and teachers, teachers and tools, or teachers and experts. Teachers found it valuable because the experts provided information and resources to the teachers, either through answering questions, sharing resources or through online discussion opportunities. For teachers, learning through the EEfS Google+ Community was a social activity with help provided by EE experts. This also aligns with Vygotsky's social constructivism, which asserts the role of guidance from *mediating agents* in learning (Ng, 2015).

Positive reinforcement, as highlighted in social learning theories, was identified as a strength of learning through the EEfS Google+ Community. Teachers perceived feedback and support from their colleagues or experts as a source of reinforcement and motivation.

The teachers in this study reported that they had feelings of isolation and lack of support. For the teachers, the collaboration and support available through the EEfS Google+ Community was motivation to join in the first place, and kept them motivated to continue to be involved in its activities. This finding was consistent with the study conducted by Trust et al. (2016) on professional learning networks for teachers, as in both contexts, it could be seen that teachers use social media to collaborate as a way to overcome isolation.

The EEfS Google+ Community provided teachers with support opportunities both through interactions with other teachers and experts, and also through resources shared by other members, enabling them to receive feedback and comments from others about their work. In this study, teachers indicated that they have found shared resources on the EEfS Google+ Community useful and that their interaction in the Community helped them to learn from observing exemplars, other students' work, and teaching materials. These findings are consistent with the findings of previous studies on social media for TPL (Greenhow et al., 2018; Krutka et al., 2016; Trust et al., 2016) as well as Social Learning Theory (Bandura, 1977, 2001), which describes the ways people learn from their observations.

As highlighted in chapter six, teachers in this study valued webinars as opportunities for synchronous interaction and communications. Similar findings were reported in a study by McConnell et al. (2012). As discussed in that study, establishing a sense of community was an important element to encourage discussion and communication in online communities. In this regard, they recommended online videoconferencing could be useful to develop a sense of being part of a group.

Connectivism can be used to explain the learning and involvement of the teachers within the EEfS Google+ Community. Their engagement shows that teachers utilised the EEfS Google+ Community to make a connection with other teachers and experts, access resources and support, and exchange knowledge and ideas. In this regard, the connectivist views of distributed knowledge as articulated by Siemens (2005), seem to be evident in the ways teachers describe their involvement in the EEfS Google+ Community. As other studies have highlighted, learning through the EEfS Google+ Community occurred through connecting teachers, information, resources, and experts. While information and resources were made available to teachers directly, they had the choice to engage with it based on what they wanted or needed. For example, teachers chose whether or not to

attend the webinars based on the topic. At the other times information and resources were shared indirectly with teachers, such as by providing links to other websites or resources. In line with connectivism, the EEfS Google+ Community focused on the information, ideas, and interaction within the community, meaning learning was therefore not a solo activity for an isolated teacher, but the participants were all connected to other people and resources.

As highlighted in the previous section, regardless of teachers' positive views towards the EEfS Google+ Community they did not fully engage with all the community's activities. Teachers explained a large number of interconnected factors affected their involvement. Lack of time, coupled with teachers' competing priorities and motivation, shaped the extent of their involvement in the EEfS Google+ Community at different times. A lack of time was consistently recognised by teachers as their main challenge regarding TPL in EE in the previous phases. Similarly, time was identified as a challenge for teachers regarding their engagement in the EEfS Google+ Community. This is in keeping with the literature, which has identified time as an obstacle for learning and TPL through social media (Chen & Bryer, 2012; Davis, 2015; Greenhow et al., 2018; Zhang et al., 2017). Lack of time has also been identified as a significant challenge more generally, and with regards to face to face professional learning as well. When lack of time prevents teachers from participating in face to face learning, which is teachers' preferred learning method, it appears to be also difficult to persuade them to spend time learning through social media. Considering that learning through social media is a relatively new and unproven method and is not teachers' first choice, convincing teachers to engage with TPL through social media is likely to remain difficult. As highlighted in previous studies, lack of time has also prevented schools from implementing and integrating EE into their school curriculum as well (Evans, Whitehouse, & Gooch, 2012; Lasen, Skamp, & Simoncini, 2017).

However, teachers expressed that "lack of time" was not their exclusive concern, but becomes more of an issue when it was combined with other factors. The teachers' involvement in the EEfS Google+ Community was not their priority as EE is not a main subject in the New Zealand Curriculum (Ministry of Education, 2007). Also, teachers claimed that their engagement in diverse EfS achievement standards (Ministry of Education, 2007) shaped their needs and expectations in terms of professional learning in

EE. They suggested that the EEfS Google+ Community did not attract many members due to teachers' conflicting purposes and expectations regarding professional learning. This indicates that teachers' busy schedules, meant they were reluctant to spend their precious time on professional learning in EE when it was not their first priority or was not related to the specific standards they were teaching and assessing. It can be argued that teachers are less motivated to spend their time on professional learning in EE because it is not perceived as a curriculum focus, but as an add-on (Eames et al., 2008, p. 45; Hill & Dymont, 2016).

The Community's limitations also influenced participants' engagement and teachers' stimulation. They mentioned that because the Community was closed, and had a limited number of members, it did not receive regular posts and updates. Therefore, teachers felt discouraged from being actively involved in the Community. There were also few responses to their own posts on the EEfS Google+ Community, which was a discouraging factor for teachers. Considering social learning views, receiving feedback on social media rewards and reinforces social media users, increasing the likelihood they will continue to interact and engage. However, in this study, teachers did not receive much feedback through the EEfS Google+ Community. Therefore, they felt discouraged from being involved in community discussions or posting material. This is similar to findings from Davis's study (2015) in which participants felt discouraged due to the lack of feedback and sense of being invisible in social media group chat. In the current study, however, teachers suggested that if a national NZQA (New Zealand Qualifications Authority) moderator or Enviroschool programme advisor would join the EEfS Google+ Community to answer teachers' questions, they would feel more motivated to participate actively.

EE stakeholders can provide teachers with channels to connect with national New Zealand experts, such as Qualifications Authority (NZQA) moderators, Enviroschool programme advisors, or other EE experts. These experts can directly support teachers by answering their questions, attending online meetings and discussions, and sharing reliable, useful resources. Their support could also be indirect. In this way, teachers would feel supported academically and emotionally, which in turn would motivate them to engage in EE and provide help and assistance for their students. Teachers, therefore, were interested to connect with EE stakeholders, as they can play an important role in connecting teachers both with reliable resources and with experts, who in turn would

encourage teachers' engagement in professional learning in EE and assist them to acquire the necessary knowledge to teach EE.

Following teachers' suggestions and considering the role of leadership in TPL programmes as one of the main factors encouraging teacher engagement with professional learning (Timperley et al., 2007), this research recommends a model for TPL that uses social media through the adoption of connectivism. The model is discussed further in the next section.

7.2 Interconnected learning communities: A model for teacher professional learning through social media in environmental education

This study assists in providing insight into TPL through social media in EE. To this end, connectivism (Siemens, 2005) was used to provide a framework for the study. This framework (Section 2.3.4.5, Figure 2.1) explains that teachers who are engaged in EE learn through connection with other teachers, experts, and information sources using social media. I was able to recognise the strengths and weaknesses of TPL through social media in the EE context by connecting teachers, EE experts and resources using Google+. It was argued in this research that observation and modelling (SLT), scaffolding in learning (ZPD), and group collaboration through LC (situated learning) are possible through social media. This research, however, has concluded that just connecting teachers and resources is inadequate for achieving the goals for TPL in EE, due to the complexity of EE in the New Zealand curricula.

Overall, findings from this study have supported and confirmed the study framework and showed that connecting with others through social media could be helpful for teachers. The study, however, identified the role and influence of EE stakeholders in TPL in EE, which was not predicted in the original model. The participation of EE stakeholders in connected TPL would be indirect but active. Their role is to support any TPL initiative (such as learning communities through social media) by, for example, assigning administrators and experts to lead the communities and help, support and motivate teachers to engage in EE. Consequent to the results from the research, the framework of connectivism has been modified as shown in Figure 7.1. In this modified model, TPL in EE occurs within a network of teachers, experts, learning communities and EE

stakeholders. Each community may have its own experts, and individual teachers may also have a connection with other experts outside the communities. Learning is therefore a process of connection and increasing involvement and interaction via a network. Such a network for teachers could be formed by connections between teachers, experts and communities, EE stakeholders, administrators, and information resources.

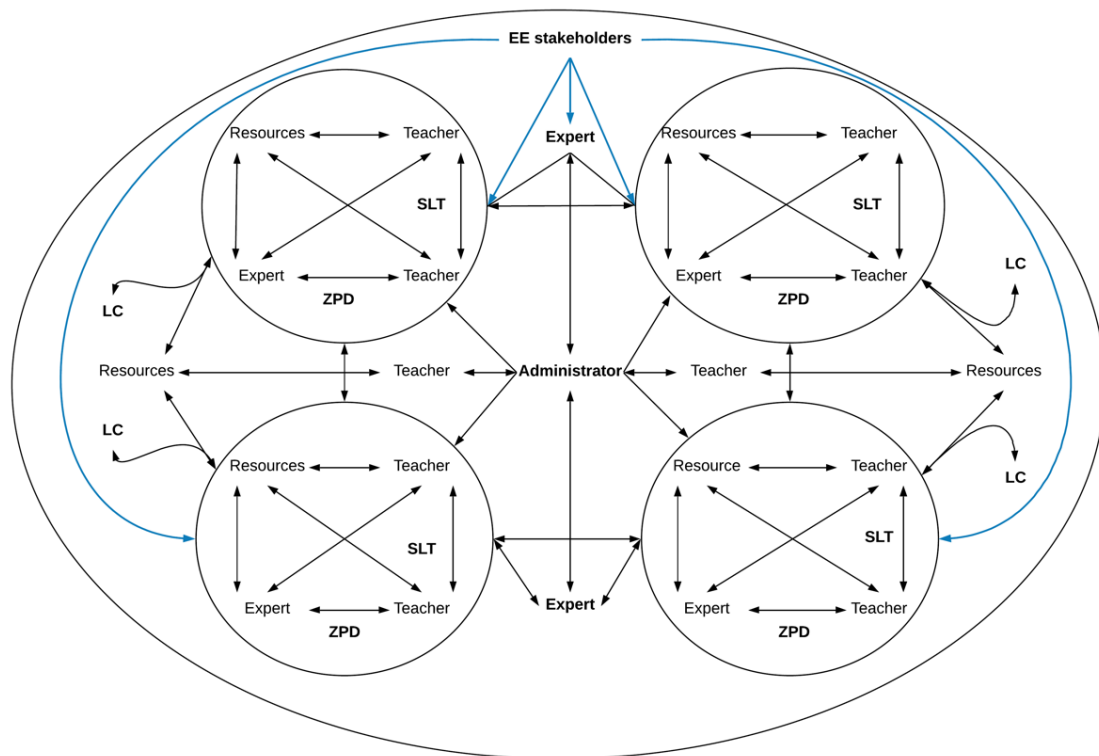


Figure 7.1 Interconnected learning communities

These communities could be formed based on teachers' common interests in a topic (for example, a specific EfS Achievement Standards) or practical activities (for instance, gardening). Communities could vary in terms of the number of members, topics and interests. Collaborative learning could occur within and across various communities and among individual teachers. Knowledge is distributed within a community, teachers can decide which resources to use, distinguish between informational materials, and select the most valuable resources, based on their priorities and needs.

As highlighted in connectivism, maintaining and developing connections is necessary to facilitate continual learning. The administrator that would be appointed by the EE stakeholder has a critical role in keeping the learning communities and connected network

of teachers alive and active. Consideration should be given to the role of administrator to organise and facilitate synchronous and asynchronous connections and communication opportunities between teachers, EE stakeholders, information resources and EE experts. The administrator would update communities and the network, monitor and moderate posts and resources, ensure the information is accurate, and advise teachers regarding their privacy concerns. Administrators would organize meetings and discussions in the form of video conferences or webinars with experts (such as moderators from NZQA or Enviroschool programme advisors), encourage and invite both experts and teachers to join. In this way, learning networks (interconnected LCs) would be interactive, updated regularly, and used widely for best results, in turn motivating teachers to connect to others and engage in LCs. More connection and more resources would keep the connected communities updated and sustained. The role of administrator is, thus, essential to direct the conversations and make sure everyone's voice is heard.

The framework uses two-way arrows to indicate the strong reciprocal connections between teachers, experts and administrators (direct) and EE stakeholders (indirect). Experts and/or administrators, would provide support for teachers, and understand their wants and needs. They would be able to communicate teachers' views and needs to the stakeholders to provide the former with further support and thus improve learning communities. This approach distinguishes learning through connected LCs from traditional TPL methods, which can be viewed as one-way communication from EE experts to teachers. Such a framework provides opportunities for all to disseminate and share their ideas, information and knowledge and also gain knowledge and information.

7.3 Limitations of applying social learning theories in this study

As mentioned in Chapter 2 (see Section 2.3.4.5), this study employed social learning theories in order to understand and explain TPL through social media. Applying these theories helped in understanding the way in which social media could be used in TPL and in gaining insight into participants' use of social media for their professional learning in EE. Social learning theories hold that learners learn through interaction, communication and collaboration. This study found that these theories can be used as a framework to map TPL through social media and facilitate collaboration among teachers. The study highlighted the strong consensus that connectivism is best aligned with teacher

collaboration through social media (see Section 7.2). Nevertheless, this study encountered certain limitations in the application of social learning theories using social media.

In line with SLT, which describes the ways people learn from observation, participants in this study found it useful to observe other teachers' work and resources shared on social media. They were concerned about the reliability of resources, however. Participants valued social media because it enabled them to receive feedback and comments from others about their work. This aspect of SLT was limited in this study as participants received relatively few comments and feedback on social media.

Social media can be used for collaboration, scaffolding and peer support, applications which align well with social constructivism. However, access to knowledgeable people who are willing to engage in social media is limited. Situated learning theory was used in this study and a learning community was established through social media. Some characteristics of learning through social media, such as lack of teachers' engagement and participation on social media, limited the application of this theory.

As teachers in this study were widely distributed, connectivism was useful in providing a framework for TPL. The application of connectivism enabled teachers to learn collaboratively through discussion, conversation and communication via social media. However, the application of connectivism depends on maintaining connections and on new information. Teachers must also distinguish between important and unimportant information, since the latter can be time-consuming.

Table 7.1 summarises the way in which social learning theories have been applied in this study, as well as the limitations that apply to each theory.

Table 7.1
Social learning theories and their limitations in this study

Theory	Application in this study	Limitation in this study
Social Learning	Observation, self-learning, feedback, and motivation through social media	Reliable resources, Feedback
Social constructivism	Social media can be used for collaboration, scaffolding and peer support	Knowledgeable people, Engagement, Participation
Situated learning	Establishing a vLC through social media	Teachers' engagement and participation
Connectivism	Teachers who are remotely distributed are able to learn collaboratively through discussions, conversations and communications via social media	Maintaining connections and new information, distinctions between important and unimportant, time consuming

7.4 Tensions in teachers' perceptions of professional learning through social media

This study found several tensions in teachers' perceptions regarding TPL through social media in EE. Contradictory findings may result from a variety of reasons lying beyond the scope of this study but should nevertheless be considered to gain a better understanding of teachers' perceptions on the subject as well as for further research in the field. The following discussion addresses these tensions.

First, as highlighted, teachers see learning as a social activity which occurs in a social context. They identified the social characteristics of social media which could be used to provide a learning environment. However, some teachers indicated that they were not interested in learning through social media, since social media cannot offer teachers the same feeling of being a part of a community that occurs in face-to-face interaction. Teachers also view EE as a practical subject, which means that it cannot be so easily studied through social media and a virtual learning environment. Consequently, they felt disinclined to learn EE through social media.

In this study, teachers acknowledged the value of social media to facilitate their professional learning in EE through peer support and collaborative learning. The study's findings indicate that such collaboration can influence teachers to make use of social

media for TPL in EE. However, they felt little motivation to do so. In spite of the significant value of social media for TPL in EE, providing peer support and collaboration opportunities, they indicated a preference for face to face interaction and communication.

It was evident from the findings that some teachers were concerned about potential privacy risks in the use of social media. They were also aware that making a professional LC open to the public would increase privacy risks. Nevertheless, in Phase 3 all participants suggested having an open social media group or page. As they observed, an open group would increase teachers' involvement in learning through social media.

As highlighted in Chapter 5, time constraints were described as among teachers' main challenges in learning through social media. Teachers explained their viewpoints when discussing these constraints. The research likewise found that these time pressures as the main reason for tensions in teachers' perceptions.

On the one hand, teachers reported that they perceived learning through social media to be beneficial due to its time-efficiency and streamlined nature. On the other hand, they claimed paradoxically that learning through social media was time-consuming. Teachers also commented that the time required for learning through social media was manageable because they could do it in their free time. Simultaneously, however, teachers saw learning through social media as extra work which would take up teachers' personal time. While teachers in this study stated that social media would give them easy access to resources and support, based on their own priorities and interests at any time and in any place, they did not feel interested enough to devote their personal time for professional learning through social media.

Teachers identified information shared on social media as the latter's strengths, because they provide access to resources for teachers and promote learning. At the same time, however, this strength of social media was also cited as one of its weaknesses, because teachers have to spend more time to find relevant material from the huge amount of information posted. In addition, participants' responses show that teachers were disinclined to spend more time online because they felt they already have to spend a great deal of time online for teaching and learning purposes. Therefore, to avoid spending more time online, some participants preferred face-to-face learning over learning through social media.

As highlighted previously, for teachers there is a tension between learning through social media and *knowing*, and *doing and learning*, which is the nature of EE. Further reflection on teachers' views shows the pressure of time in shaping teachers' perceptions. For example, a teacher commented on the questionnaire, "You can read how to make a worm farm, but that does not mean you can or will make the time to do it and maintain it" (T114). For EE teachers the knowledge gained merely by reading through social media is incomplete until reinforced by practice. For teachers to make use of their learning through social media, therefore, they need time.

Finally, the study's target population was Enviroschools' EE lead teachers. As such, they should be committed to TPL in EE. However, some teachers clearly emphasised that TPL in EE was not their priority. It was also evident from teachers' responses that although they were passionate about EE, they were not dedicated to TPL in EE, as it was not their priority and they did not feel motivated. The question then arises, if TPL in EE is not a priority for EE lead teachers from Enviroschools, for whom is it a priority? Who is willing to learn and teach EE if lead teachers have other commitments which prevent them from learning about EE, which is their passion and responsibility?

7.5 Conclusions

Taking the crucial role of teachers in guiding their students in understanding EE into consideration, TPL plays an essential role in achieving the goals of EE. Teacher professional learning offers teachers new knowledge and skills to enhance their teaching practice which in turn improves student outcomes in EE. Teacher professional learning through social media is regarded as an effective TPL method due to being collaborative, ongoing, and integrated into teachers' practice.

In this study, teachers considered EE to be an important aspect of education. Environmental education was perceived as a learning process incorporating awareness and action. As perceived by teachers in this study, improving environmental knowledge, value and skills among students would help to achieve sustainability. For teachers in this study, to improve EE and succeed in achieving the goal of EE, enhancing teachers' knowledge and skills would help. Therefore, TPL was viewed as important in improving their pedagogical content knowledge. As reported in this study, teachers saw the possibility and advantages of TPL in EE through social media. Also, the study made it

evident that social media were being employed by participants for learning, both professional and general. The study also indicates that teachers' social media usage is not limited to one platform. Different platforms are used by teachers for a variety of purposes. It was shown that social media usage for professional learning in EE is limited.

This study of teachers' perceptions and experiences has led to the conclusion that visits to other schools and observing other teachers' work (SLT, ZPD), opportunities to put questions to EE experts (ZPD), and peer collaboration to receive support and feedback from teachers or experts (ZPD, LC) are the most effective TPL methods in EE. This finding accords with connectivism theory, which maintains that connecting teachers with information, people and resources can help teachers to overcome teaching challenges in EE.

This study has found that teachers look for, and value, synchronous support and feedback, whether from their peers or experts, directly or through social media. Overall, the findings of this study confirm that social media have significant value for TPL in EE and provide peer support and collaboration opportunities for teachers. These findings endorse the view that social media have potential for TPL in EE but platforms and infrastructure remain issues to consider.

The main conclusion to be drawn from this study is that teachers view TPL in EE as a social activity. They have a strong desire to connect with EE experts, EE stakeholders and one another in social settings. They see the potential of social media to facilitate this connection and provide collaborative learning experiences. Social media were endorsed by teachers as a means to provide them with a sense of being part of a learning community from which they could receive intellectual and emotional support. Teachers perceived the usefulness of social media to provide collaboration opportunities in EE. Through social media, teachers have access to knowledge, resources and learning opportunities. While the study showed that a very high percentage of teachers would consider using social media for professional learning in EE, they were mostly interested in using social media as a complement to face-to-face learning.

However, TPL in EE through social media is complex, as many factors are involved in the process. Priorities and motivations play an important role in teachers' involvement in learning through social media. Teachers found that the volume of information shared on

social media was overwhelming. The question of privacy in participation was also seen as a significant barrier. In previous studies, lack of time was identified as a challenge for teachers seeking face to face professional learning which this study confirms. Consequently, teachers need greater motivation to spend their time on professional learning in EE.

Evidence from the current study confirms that connection with others through an interconnected network of communities and individuals would be helpful but not sufficient for TPL. The non-mandatory status of EE in NZC results only in extremely motivated teachers to devote their time to learning through social media in EE. This study therefore has identified the role of EE stakeholders as active leaders and among the main factors so that teachers can be inspired to engage with professional learning in EE.

7.6 Implications and recommendations

This study aims to understand teachers' perceptions and experiences of TPL through social media in EE. The findings from this study, therefore, have important implications and recommendations for theory, practice, and research in EE.

- Findings from this study emphasise the need for TPL in EE, as teachers need support to improve both their content knowledge and EE pedagogy. It is evident from this study, though, that learning through social media cannot be the only TPL method for teachers. The study also suggests that teachers are aware of the potential use of social media in TPL in EE and would use it for their professional learning. Therefore, social media can be used to provide the support needed for collaboration, networking and information sharing within institutions, in follow-up TPL programmes, or in blended TPL.
- The study points out that teachers have different social media preferences, which can influence their engagement in learning through social media. A combination of social media platforms should be used in order to design TPL through social media in any discipline.
- Another important implication of the study derives from findings on the use of social media among teachers. While teachers have different social media preferences, most of them utilise YouTube for learning. One possibility would be

that the Ministry of Education can create step-by-step short video tutorials with the help of professionals. Short YouTube videos of 10 minutes can explain key EE concepts and teaching methods related to each concept; for example, a series of “How to” or “Why do” tutorials, such as tutorials on “How to integrate EE into science” or how to engage students in a specific EE activity. Teachers can be active participants in these videos by giving tutorials, sharing photos or leaving comments in the comment section. The use of YouTube videos would increase teacher engagement in EE. These videos could be accessed at any time of day and in a place that suits teachers, who could watch a video several times if a concept was not clear to them. They could also make comments and ask questions in the comment section. Later, their comments and questions could be answered by other teachers and professionals, or even by new or existing videos. However, it was noticed in the course of this study that YouTube videos are viewed but teachers do not engage much in the comment sections. So these videos could be used as additional resource in addition to a collaborative platforms.

- Professional learning in EE is not a priority for teachers because in the New Zealand curriculum EE is not mandatory. Thus, teachers’ motivations play a critical role in their engagement as active participants in TPL through social media. Motivation factors need to be considered in designing and conducting any form of TPL programme, particularly through social media. Teachers should be encouraged to join the programme not only prior to its commencement, but they should also be kept motivated to continue their engagement as active learners.
- Taking their time constraints into account, teachers felt that TPL in EE is not a priority for them. It is recommended that schools consider how they can give teachers the opportunity to use social media during school hours for professional learning purposes. Making the best use of the time available during their school hours might enhance teachers’ engagement in professional learning through social media.
- Teachers saw the value of synchronous interaction with EE teachers and experts and asynchronous support from other teachers through social media. For synchronous communication, EE stakeholders could organise monthly or

fortnightly webinars for teachers to discuss their questions and challenges regarding EE teaching. An online chat room or chat forums with a moderator from NZQA or an EnviroSchool programme advisor would provide synchronous learning opportunities for teachers. Asynchronous communication could be provided by assigning an administrator who would find answers for teachers' questions or refer them to the right source of information.

7.7 Limitations of the study

This study has certain limitations. First, the primary method of data collection was self-reporting, which is constrained by the absence of verification and various biases which may affect the study. To minimize potential bias that might result from self-reporting, the findings were categorised on the basis of major themes represented by the majority of teachers.

Second, the teachers in this study were voluntary participants. In consequence, it is possible that they had a greater commitment and interest in professional learning through social media than other teachers. Their answers may reflect their interests and could be exaggerated. Also, the study was limited by the number of participants who volunteered to participate in Phase two and three. In Phase three, however, the number of participants fairly represented the population of teachers who are involved in teaching EfS Achievement Standards (see section 7.1.4).

In addition, this research was confined to the context of TPL in EE. Data were gathered from EnviroSchools lead teachers in New Zealand. Some of the findings from this research may not reflect the opinion of teachers in general schools in New Zealand.

The study was limited to an investigation of the way teachers perceive and describe their learning through social media. Its focus was on understanding teachers' perceptions and experiences in TPL through social media, rather than on the way they use this learning to improve their EE teaching. Consequently, no attention was given to the influence of TPL on their efforts as teachers to improve student knowledge, attitudes, values and actions toward sustainability. In other words, the research did not attempt to examine the effect of the teachers' learning to their practice. The effect on student learning of TPL through social media was also not taken into consideration in this study.

7.8 Suggestions for further research

The drawbacks of the current study need to be addressed in further research. First, whereas social media in this research were considered as an educational tool to assist collaborative learning among teachers, little is known about how they can be used for professional learning purposes to support teachers in changing their practice. Regarding learning through social media, future implementations and research should observe teachers' activities on social media and the way they apply their learning in their EE teaching practice.

Secondly, further research should address the relationship between TPL through social media and student learning outcomes. It is also very important for future research to include and highlight the role of TPL in shaping EE educational aims for improving students' knowledge, values, attitudes, and skills toward sustainability. Moreover, further research on TPL through social media is needed to discover teachers' motivations in TPL in EE in general and TPL in EE through social media.

Finally, EE is an important area of learning for students and there is no doubt that it will become critical in the future years. My research provides a stepping stone to future researchers in EE who could build on the findings from this research to create robust learning communities in various social media platforms and thus help teachers to educate students on the importance and criticality of their actions on the environment.

References

- Admiraal, W., Kruiter, J., Lockhorst, D., Schenke, W., Sligte, H., Smit, B., . . . De Wit, W. (2016). Affordances of teacher professional learning in secondary schools. *Studies in Continuing Education*, 38(3), 281-298.
doi:10.1080/0158037X.2015.1114469
- Åkerlind, G. S. (2012). Variation and commonality in phenomenographic research methods. *Higher Education Research & Development*, 31(1), 115-127.
- Akoumianakis, D. (2009). *Virtual community practices and social interactive media: Technology lifecycle and workflow analysis*. Harshey, PA: Information Science Reference.
- Al-Samarraie, H., & Saeed, N. (2018). A systematic review of cloud computing tools for collaborative learning: Opportunities and challenges to the blended-learning environment. *Computers & Education*, 124, 77-91.
- Alexandar, R., & Poyyamoli, G. (2014). The effectiveness of environmental education for sustainable development based on active teaching and learning at high school level: A case study from Puducherry and Cuddalore regions, India. *Journal of Sustainability Education*, 7, 1-20.
- Alhassan, R. (2016). Mobile learning as a method of ubiquitous learning: Students' attitudes, readiness, and possible barriers to implementation in higher education. *Journal of Education and Learning*, 5(1), 176-189.
- Anderson, T. (2006). Higher education evolution: Individual freedom afforded by educational social software. In M. F. Beaudoin (Ed.), *Perspectives on Higher Education in the Digital Age* (pp. 77-90). New York, NY: Nova Science Publishers.
- Arkorful, V., & Abaidoo, N. (2015). The role of e-learning, advantages and disadvantages of its adoption in higher education. *International Journal of Instructional Technology and Distance Learning*, 12(1), 29-42.
- Ashworth, P., & Lucas, U. (1998). What is the 'World' of phenomenography? *Scandinavian Journal of Educational Research*, 42(4), 415-431.
doi:10.1080/0031383980420407
- Athman, J. A., & Monroe, M. C. (2001). Elements of effective environmental education programs. 1-14. Retrieved from <http://files.eric.ed.gov/fulltext/ED463936.pdf>
- Awasthi, A. K., Zeng, X., & Li, J. (2016). Environmental pollution of electronic waste recycling in India: A critical review. *Environmental Pollution*, 211, 259-270.
- Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

- Bandura, A. (2001). Social cognitive theory of mass communication. *Media Psychology*, 3(3), 265-299. doi:10.1207/s1532785xmep0303_03
- Barker, M., & Rogers, L. (2004). "In, about and for": Exploring the foundations of environmental education. *Set: Research Information for Teachers*, 2, 15-18. Retrieved from <https://www.nzcer.org.nz/nzcerpress/set/articles/about-and-exploring-foundations-environmental-education>
- Barlow, M. (2003). *Blue gold: The battle against corporate theft of the world's water*. London, United Kingdom: Earthscan.
- Bazeley, P., & Jackson, K. (2013). *Qualitative data analysis with NVivo* (2nd ed.). London, England: SAGE.
- Beach, R. (2012). Can online learning communities foster professional development? *Language Arts*, 89(4), 256-262.
- Beck, C., & Kosnik, C. (2014). *Growing as a teacher: Goals and pathways of ongoing teacher learning*. Rotterdam, Netherlands: Sense.
- Beetham, H., & Sharpe, R. (2013). *Rethinking pedagogy for a digital age designing for 21st century learning* (2 ed.). New York, NY: Routledge.
- Bell, F. (2011). Connectivism: Its place in theory-informed research and innovation in technology-enabled learning. *The International Review of Research in Open and Distributed Learning*, 12(3), 98-118.
- Belshaw, C. (2001). *Environmental philosophy: Reason, nature and human concern*. Chesham, England: Acumen.
- Bergl, P., & Muntz, M. (2016). Using social media to enhance health professional education. *The Clinical Teacher*, 13(6), 399-404.
- Bergstrom, J. (2016). *Resource economics : An economic approach to natural resource and environmental policy*. Cheltenham, England: Edward Elgar Publishing.
- Berner, A., Lobo, S., & Silva, N. (2013). *A Strategic and Transformative Approach to Education for Sustainable Development* (Masters thesis, Blekinge Institute of Technology, Karlskrona, Sweden). Retrieved from <http://bth.diva-portal.org/smash/record.jsf?pid=diva2%3A830314&dswid=7231>
- Bexheti, L. A., Ismaili, B. E., & Cico, B. H. (2014). *An analysis of social media usage in teaching and learning: The case of SEEU*. Paper presented at the International Conference on Circuits, Systems, Signal Processing, Communications and Computers, Saint Petersburg, Russia. <http://www.inase.org/library/2014/>
- Bezdek, R., Ferris, D., Kadri, J., Wolcott, R., Drayton, W., Alley, K., . . . Fly, J. M. (1995). *Environmental justice: Issues, policies, and solutions*. Washington, DC: Island Press.

- Birdsall, S. (2010). Empowering students to act: Learning about, through and from the nature of action. *Australian Journal of Environmental Education*, 26, 65-84. doi:10.1017/S0814062600000835
- Blackburn, A. M. (1983). Steps along the path: The UNESCO/UNEP international environmental education program. *Environmentalist*, 3(4), 269-276.
- Bolkan, J. (2014). Most teachers use social media, worry it will cause conflict. *THE Journal*. Retrieved from <https://thejournal.com/articles/2014/01/15/report-most-teachers-use-social-media-worry-it-will-cause-conflict.aspx>
- Bolstad, R. (2003). Environmental education: Roots in the past, visions of the future, opportunities in the present. *Set: Research Information for Teachers*, 3, 10-14.
- Bolstad, R. (2005). Environmental education: A place in the curriculum? *New Zealand Annual Review of Education*, 14, 215-235.
- Bolstad, R., Cowie, B., Eames, C., Baker, M., Keown, P. A., Edwards, R., . . . Rogers, N. (2004). *Environmental education in New Zealand schools*. Wellington, New Zealand: Ministry of Education.
- Bolstad, R., Eames, C., & Robertson, M. (2008). *The state of environmental education in New Zealand: A baseline assessment of provision in the formal education sector in 2006*. Wellington, New Zealand: WWF.
- Bolstad, R., Joyce, C., & Hipkins, R. (2015). *Environmental education in New Zealand schools: Research update 2015*. Wellington, New Zealand: Ministry of Education.
- Boulton, H., & Hramiak, A. (2012). E-flection: The development of reflective communities of learning for trainee teachers through the use of shared online web logs. *Reflective Practice*, 13(4), 503-515. doi:10.1080/14623943.2012.670619
- Bowden, J. A. (2005). Reflections on the phenomenographic team research process. In J. A. Bowden & P. Green (Eds.), *Doing developmental phenomenography* (pp. 11-31). Melbourne, Australia: RMIT University Press.
- Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, 9(2), 27-40.
- Bowler, I. R. (1992). *The Geography of agriculture in developed market economies*. Harlow, England: Longman Scientific & Technical.
- Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. Thousand Oaks, CA: SAGE.
- Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, 13(1), 210-230.
- Breiting, S., & Mogensen, F. (1999). Action competence and environmental education. *Cambridge Journal of Education*, 29(3), 349-353.

- Brimblecombe, P. (2019). War and urban-industrial air pollution in the UK and the US. In S. Laakkonen, J. R. McNeill, R. P. Tucker, & T. O. Vuorisalo (Eds.), *The resilient city in World War II* (pp. 69-80). Cham, Switzerland Palgrave Macmillan.
- Brooks, C., & Gibson, S. (2012). Professional learning in a digital age. *Canadian Journal of Learning and technology*, 38(2), 1-17.
- Brulle, R. J., & Rootes, C. (2015). Environmental movements. *International Encyclopedia of the Social & Behavioral Sciences*, 7, 763-768. doi:10.1016/B978-0-08-097086-8.91016-X
- Brundtland, G., Khalid, M., Agnelli, S., Al-Athel, S., Chidzero, B., Fadika, L., . . . de Botero, M. M. (1987). *Our common future (Brundtland report)*. New York, NY: Oxford University Press.
- Bruner, J. S. (1960). *The process of education*. Cambridge, MA: Harvard University Press.
- Bryer, T. A., & Zavattaro, S. M. (2011). Social media and public administration: Theoretical dimensions and introduction to the symposium. *Administrative Theory & Praxis*, 33(3), 325-340.
- Buckler, C., & Creech, H. (2014). *Shaping the future we want: UN Decade of Education for Sustainable Development* (Final report). Retrieved from <https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=1682&menu=35>
- Burnard, P., Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Analysing and presenting qualitative data. *British Dental Journal*, 204(8), 429-432. doi:10.1038/sj.bdj.2008.292
- Burton, D., & Bartlett, S. (2009). *Key issues for education researchers*. Los Angeles, CA: SAGE.
- Buttel, F. H. (1975). The environmental movement: Consensus, conflict, and change. *The Journal of Environmental Education*, 7(1), 53-63.
- Çalik, M., & Eames, C. (2012). The significance of national context: A comparison of environmental education in Turkey and New Zealand. *Asia Pacific Education Researcher*, 21(3), 423-433.
- Cameron, S., Mulholland, J., & Branson, C. (2013). Professional learning in the lives of teachers: Towards a new framework for conceptualising teacher learning. *Asia-Pacific Journal of Teacher Education*, 41(4), 377-397. doi:10.1080/1359866x.2013.838620
- Carpenter, J. P. (2014). Twitter's capacity to support collaborative learning. *International Journal of Social Media and Interactive Learning Environments*, 2(2), 103-118.

- Carpenter, J. P., & Harvey, S. (2019). "There's no referee on social media": Challenges in educator professional social media use. *Teaching and Teacher Education*, 86. doi:10.1016/j.tate.2019.102904
- Carpenter, J. P., Kimmons, R., Short, C. R., Clements, K., & Staples, M. E. (2019). Teacher identity and crossing the professional-personal divide on twitter. *Teaching and Teacher Education*, 81. doi:10.1016/j.tate.2019.01.011
- Carpenter, J. P., & Krutka, D. G. (2014). Engagement through microblogging: Educator professional development via Twitter. *Professional Development in Education*, 41(4), 707-728. doi:10.1080/19415257.2014.939294
- Carr, N., & Chambers, D. P. (2006). Teacher professional learning in an online community: The experiences of the National Quality Schooling Framework Pilot Project. *Technology, Pedagogy and Education*, 15(2), 143-157.
- Carson, R. (1962). *Silent spring*. London, England: Hamish Hamilton.
- Chaffey, D. (2019). *Global social media research summary 2019*. Retrieved from <https://www.smartinsights.com/social-media-marketing/social-media-strategy/new-global-social-media-research/>
- Chai, C., & Kong, S.-C. (2017). Professional learning for 21st century education. *Journal of Computers in Education*, 4(1), 1-4. doi:10.1007/s40692-016-0069-y
- Chalmers, J. (2011). *Education for sustainability: An investigation of teachers' and students' perceptions and experiences*. (Doctoral thesis, University of Waikato, Hamilton, New Zealand Master of Education (MEd)). University of Waikato, Hamilton, New Zealand. Retrieved from <https://researchcommons.waikato.ac.nz/handle/10289/5957>
- Chambers, R. (2006, December). What is Poverty? Who asks? Who answers? *Poverty in Focus*, 3-4. Retrieved from <https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/120/rc145.pdf?s>
- Chen, B., & Bryer, T. (2012). Investigating instructional strategies for using social media in formal and informal learning. *The International Review of Research in Open and Distributed Learning*, 13(1), 87-104.
- Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education*. Abingdon, England: Routledge.
- Collins, A., & Halverson, R. (2018). *Rethinking education in the age of technology: The digital revolution and schooling in America*. New York, NY: Teachers College Press, Columbia University.
- Cowie, B., & Eames, C. (2004). Environmental education in New Zealand schools: Challenges for sustainability. *Set: Research Information for Teachers*, 3, 19-23.
- Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. New York, NY: SAGE.

- Creswell, J. W., & Creswell, J. D. (2005). Mixed methods research: Developments, debates, and dilemmas. In R. A. Swanson & E. F. Holton (Eds.), *Research in organizations: Foundations and methods of inquiry* (pp. 315-326). San Francisco, CA: Berrett-Koehler.
- Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. London, United Kingdom: SAGE.
- Dabbagh, N., & Reo, R. (2011). Back to the future: Tracing the roots and learning affordances of social software. In M. J. W. Lee & C. McLoughlin (Eds.), *Web 2.0-based e-learning: Applying social informatics for tertiary teaching* (pp. 1-20). Hershey, PA: Information Science Reference.
- Dada, O. D. (2018). *Evaluation of environmental literacy of pre-service teachers in New Zealand*. (Doctoral thesis, University of Waikato, Hamilton, New Zealand). Retrieved from <https://hdl.handle.net/10289/12033>
- Darling-Hammond, L., & McLaughlin, M. W. (2011). Policies that support professional development in an era of reform. *Phi Delta Kappan*, 92(6), 81-92.
- Darling-Hammond, L., Wei, R. C., Andree, A., Richardson, N., & Orphanos, S. (2009). *Professional learning in the learning profession: A status report on teacher development in the US and abroad*. Dallas, TX: National Staff Development Council.
- Davis, K. (2015). Teachers' perceptions of Twitter for professional development. *Disability and Rehabilitation*, 37(17), 1551-1558. doi:10.3109/09638288.2015.1052576
- Dawson, S. (2008). A study of the relationship between student social networks and sense of community. *Journal of Educational Technology & Society*, 11(3), 224-238.
- De Neve, D., Devos, G., & Tuytens, M. (2015). The importance of job resources and self-efficacy for beginning teachers' professional learning in differentiated instruction. *Teaching and Teacher Education*, 47, 30-41. doi:10.1016/j.tate.2014.12.003
- Deluca, C., Shulha, J., Luhanga, U., Shulha, L. M., Christou, T. M., & Klinger, D. A. (2014). Collaborative inquiry as a professional learning structure for educators: A scoping review. *Professional Development in Education*, 41(4), 1-31. doi:10.1080/19415257.2014.933120
- Department of Conservation. (2019). Mātauranga whakauka taiao: Environmental education for sustainability. *Environmental education for sustainability strategy and action plan*. Retrieved from <https://www.doc.govt.nz/about-us/our-policies-and-plans/education-strategies/environmental-education-for-sustainability-strategy-and-action-plan/>
- Derevenskaia, O. (2014). Active learning methods in environmental education of students. *Procedia-Social and Behavioral Sciences*, 131, 101-104. doi:10.1016/j.sbspro.2014.04.086

- Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, 38(3), 181-199. doi:10.3102/0013189x08331140
- DiPaola, M. F. (2012). Conceptualizing and validating a measure of principal support. In M. F. DiPaola & P. B. Forsyth (Eds.), *Contemporary challenges confronting school leaders* (pp. 111-120). Charlotte, NC: Information Age Publishing.
- Dowling, R. (1993). Environmental education in New Zealand. *Australian Journal of Environmental Education*, 9(4), 21-34. doi:10.1017/S0814062600003165
- Downes, S. (2005). *An introduction to connective knowledge*. Paper presented at the Media, knowledge & education exploring new spaces, relations and dynamics in digital media ecologies, Innsbruck, Austria.
<https://www.oapen.org/download?type=document&docid=449459>
- Downes, S. (2007). What connectivism is [Press release]. Retrieved from <http://halfanhour.blogspot.co.nz/2007/02/what-connectivism-is.html>
- Dron, J., & Anderson, T. (2014). On the design of social media for learning. *Social Sciences*, 3(3), 378-393. doi:10.3390/socsci3030378
- Drumbl, M. A. (1998). Waging war against the world: The need to move from war crimes to environmental crimes. *Fordham International Law Journal*, 22(1), 122-153.
- Eames, C. (2010). *Part two: Report on the Enviroschools Programme*. Retrieved from <https://www.educationcounts.govt.nz/>
- Eames, C., & Barker, M. (2011). Understanding student learning in environmental education in Aotearoa New Zealand. *Australian Journal of Environmental Education*, 27(1), 186-191. Retrieved from <http://dx.doi.org.ezproxy.waikato.ac.nz/10.1017/S0814062600000173>
- Eames, C., Barker, M., Wilson-Hill, F., & Law, B. (2010). *A Framework for Developing Action Competence in Education for Sustainability (EfS)*. Retrieved from Wellington, New Zealand:
- Eames, C., Bolstad, R., & Cowie, B. (2004). *Evaluation of the practice of environmental education in New Zealand schools*. Paper presented at the American Educational Research Association (AERA) conference.
<https://www.nzcer.org.nz/research/publications/evaluation-practice-environmental-education-new-zealand-schools>
- Eames, C., Cowie, B., & Bolstad, R. (2008). An evaluation of characteristics of environmental education practice in New Zealand schools. *Environmental Education Research*, 14(1), 35-51.
- Eames, C., Roberts, J., Cooper, G., & Hipkins, R. (2010). *Education for sustainability in New Zealand schools: An evaluation of three professional development programmes*. Retrieved from <https://www.educationcounts.govt.nz/>

- Education Council. (2016). *Graduating teacher standards: Aotearoa New Zealand*. Retrieved from <https://educationcouncil.org.nz/content/graduating-teacher-standards>
- Enviroschools. (2015). *Enviroschools: Key findings from the nationwide census*. Retrieved from http://www.enviroschools.org.nz/outcomes_and_benefits/2014-evaluation/Enviroschools_census_WEB21.pdf
- Enviroschools. (2016). *Enviroschools*. Retrieved from <http://www.enviroschools.org.nz>
- Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly*, 26(2), 43-71. doi:10.1002/piq.21143
- Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education*, 59(2), 423-435. doi:10.1016/j.compedu.2012.02.001
- Evans, N., Whitehouse, H., & Gooch, M. (2012). Barriers, successes and enabling practices of education for sustainability in far north Queensland schools: A case study. *Journal of Environmental Education*, 43(2), 121-138. doi:10.1080/00958964.2011.621995
- Evans, N. S., Whitehouse, H., & Hickey, R. (2012). Pre-service teachers' conceptions of education for sustainability. *Australian Journal of Teacher Education*, 37(7), 1-12. doi:10.14221/ajte.2012v37n7.3
- Facebook. (2019). *Facebook: About*. Retrieved from <https://www.facebook.com/facebook/about/>
- Fien, J. (1993). *Education for the environment: Critical curriculum theorising and environmental education*. Geelong, Australia: Deakin University.
- Finch, K. C., Snook, K. R., Duke, C. H., Fu, K.-W., Tse, Z. T. H., Adhikari, A., & Fung, I. C.-H. (2016). Public health implications of social media use during natural disasters, environmental disasters, and other environmental concerns. *Natural Hazards*, 83(1), 729-760.
- Forbes, D. (2012). *Footprints: Participant perspectives informing pedagogy for asynchronous online discussion in initial teacher education*. (Doctoral thesis, University of Waikato, Hamilton, New Zealand). Retrieved from <http://hdl.handle.net/10289/7108>
- Forbes, D. (2015). *Building connections: Professional online presence and learning networks*. Paper presented at the Proceedings of the 2nd European Conference on Social Media, Porto, Portugal. <http://researchcommons.waikato.ac.nz/handle/10289/9473>
- Foroughi, A. (2015). The theory of connectivism: Can it explain and guide learning in the digital age? *Journal of Higher Education Theory and Practice*, 15(5), 11-26.

- Frame, B., & Marguardt, M. (2006). *Implication for sustainable development programme of action*. Retrieved from http://www.landcareresearch.co.nz/publications/researchpubs/LCR_SDPOA_review_2006
- Frantz, C. M., & Mayer, F. S. (2014). The importance of connection to nature in assessing environmental education programs. *Studies in Educational Evaluation*, 41, 85-89.
- Fuchs, C. (2017). *Social media: A critical introduction*. Thousand Oaks, CA: SAGE.
- Gall, M. D., Borg, W., & Gall, J. (2007). *An introduction to educational research*. New York, NY: Pearson Education.
- Gannon-Leary, P., & Fontainha, E. (2007). Communities of practice and virtual learning communities: Benefits, barriers and success factors. *eLearning Papers*(5), 1-14.
- Gardner, H. (2006). *Five minds for the future*. Boston, MA: Harvard Business School Press.
- Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, 38(4), 915-945.
- Gerdeman, D., Garrett, R., & Monahan, B. (2018). Teacher professional learning through teacher network programs: A multiple case study investigation. *American Institutes for Research*. Retrieved from <https://files.eric.ed.gov/fulltext/ED585477.pdf>
- Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Education*, 19, 18-26.
- Goldie, J. G. S. (2016). Connectivism: A knowledge learning theory for the digital age? *Medical teacher*, 38(10), 1064-1069.
- Gonzales, L., & Young, C. (2015). Can social media impact learning. *Tech & Learning*, 35(8), 36.
- Goodyear, V. A., Casey, A., & Kirk, D. (2014). Tweet me, message me, like me: Using social media to facilitate pedagogical change within an emerging community of practice. *Sport, Education and Society*, 19(7), 927-943. doi:10.1080/13573322.2013.858624
- Goudie, A. S. (2018). *Human impact on the natural environment: Past, present and future*. Oxford, United Kingdom: John Wiley & Sons.
- Gough, A. (2013). The emergence of environmental education research. In R. B. Stevenson, M. Brody, J. Dillon, & A. E. Wals (Eds.), *International handbook of research on environmental education* (pp. 13-22). New York, NY: Routledge.

- Gough, A., & Sharpley, B. (2005). *Educating for a sustainable future: A national environmental education statement for Australian schools*. Melbourne, Australia: Curriculum Corporation.
- Gray, D. E. (2014). *Doing research in the real world* (3rd ed.). London, England: SAGE.
- Green, P., & Bowden, J. A. (2009). Principles of developmental phenomenography. *The Malaysian Journal of Qualitative Research*, 2(2), 52-70.
- Greenhalgh, S. P., & Koehler, M. J. (2017). 28 days later: Twitter hashtags as “just in time” teacher professional development. *TechTrends*, 61(3), 273-281. doi:10.1007/s11528-016-0142-4
- Greenhow, C., Campbell, D., Galvin, S., & Askari, E. (2018). *Social media in teacher professional development: A literature review*. Paper presented at the Society for Information Technology & Teacher Education International Conference, Washington, DC.
- Grigg, J., Kelly, K. A., Gamoran, A., & Borman, G. D. (2012). Effects of two scientific inquiry professional development interventions on teaching practice. *Educational Evaluation and Policy Analysis*, 35(1), 38-56. doi:10.3102/0162373712461851
- Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology: A Journal of Theory, Research, and Development*, 29(2), 75-91.
- Guba, E. G. (1990). *The Paradigm dialog*. Newbury Park, CA: SAGE.
- Guest, G., MacQueen, K. M., & Namey, E. E. (2011). *Applied thematic analysis*. Los Angeles, CA: SAGE.
- Hajli, M., Bugshan, H., Lin, X., & Featherman, M. (2013). From e-learning to social learning: A health care study. *European Journal of Training and Development*, 37(9), 851-863. doi:10.1108/ejtd-10-2012-0062
- Hao, Y., & Lee, K. S. (2015). Teachers’ concern about integrating Web 2.0 technologies and its relationship with teacher characteristics. *Computers in Human Behavior*, 48, 1-8. doi:10.1016/j.chb.2015.01.028
- Hart, J. (2011). *Social learning handbook: A practical guide to using social media to work and learn smarter*. Corsham, England: Centre for Learning & Performance Technologies.
- Heimlich, J. E., & Ardoin, N. M. (2008). Understanding behavior to understand behavior change: A literature review. *Environmental Education Research*, 14(3), 215-237.
- Hertel, J., & Wessman-Enzinger, N. (2017). Examining Pinterest as a curriculum resource for negative integers: An initial investigation. *Education Sciences*, 7(2). doi:10.3390/educsci7020045

- Hewitt, J., Bell, D., Simmons, G. C., Rivera-Aban, M., Wolf, S., & Greening, G. E. (2007). Gastroenteritis outbreak caused by waterborne norovirus at a New Zealand ski resort. *Applied and Environmental Microbiology*, 73(24), 7853-7857.
- Hill, A., & Dymont, J. E. (2016). Hopes and prospects for the sustainability cross-curriculum priority: Provocations from a state-wide case study. *Australian Journal of Environmental Education*, 32(3), 225-242. doi:10.1017/ae.2016.20
- Holmes, K., Preston, G., Shaw, K., & Buchanan, R. (2013). Follow me: Networked professional learning for teachers. *Australian Journal of Teacher Education*, 38(12), 55-65.
- Hou, H. (2015). What makes an online community of practice work? A situated study of Chinese student teachers' perceptions of online professional learning. *Teaching and Teacher Education*, 46, 6-16. doi:10.1016/j.tate.2014.10.005
- House, J. S., Landis, K. R., & Umberson, D. (1988). Social relationships and health. *Science*, 241(4865), 540-545.
- Howe, R. W., & Disinger, J. F. (1991). Environmental education research news. *The Environmentalist*, 11(1), 5-8.
- Howland, J. L. (2012). *Meaningful learning with technology* (4th ed.). Boston, MA: Pearson.
- Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education*, 21(3), 8-21.
- International Union for Conservation of Nature and Natural Resources, & UNESCO. (1970). *International working meeting on environmental education in the school curriculum*. Retrieved from <https://eric.ed.gov/?id=ED045490>
- Jackson, S. (2009). *Enviroschools in New Zealand*. Retrieved from <http://www.review.mai.ac.nz>
- Jensen, B. B. (2002). Knowledge, action and pro-environmental behaviour. *Environmental Education Research*, 8(3), 325-334.
- Jensen, B. B., & Schnack, K. (2006). The action competence approach in environmental education. *Environmental Education Research*, 12(3-4), 471-486. doi:10.1080/13504620600943053
- Jensen, K. B. (2013). *A handbook of media and communication research: Qualitative and quantitative methodologies*. New York, NY: Routledge.
- Johnson, B., & Christensen, L. (2004). *Educational research: Quantitative, qualitative and mixed approaches*. Thousand Oaks, CA: Pearson Education.
- Johnson, B., & Christensen, L. B. (2012). *Educational research: quantitative, qualitative, and mixed approaches* (Vol. 4th). Thousand Oaks, Calif: SAGE.

- Johnson, J., & Maddox, J. (2012). Use of social media in graduate education: An exploratory review for breaking new ground. *Journal of Higher Education Theory and Practice*, 12(3), 87-93.
- Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2014). *NMC Horizon Report: 2014 K-12 Edition*. Retrieved from Austin, TX:
- Johnson, S. P. (1993). *The Earth Summit: The United Nations Conference on Environment and Development (UNCED)*. London, United Kingdom: Graham & Trotman.
- Jonker, J., & Pennink, B. (2010). *The essence of research methodology: A concise guide for master and PhD students in management science*. Berlin, Germany: Springer.
- Kabilan, M. K., Adlina, W. F. W., & Embi, M. A. (2011). Online collaboration of english language teachers for meaningful professional development experiences. *English Teaching: Practice and Critique*, 10(4), 94-115.
- Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business horizons*, 53(1), 59-68.
- Kapoor, K. K., Tamilmani, K., Rana, N. P., Patil, P., Dwivedi, Y. K., & Nerur, S. (2018). Advances in social media research: Past, present and future. *Information Systems Frontiers*, 20(3), 531-558.
- Killion, J. (2011). The changing face of professional development. *EDge: The Latest Information for the Education Practitioner*, 6(5), 3-19.
- Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239-260.
doi:10.1080/13504620220145401
- Kolokytha, E., Loutrouki, S., Valsamidis, S., & Florou, G. (2015). Social media networks as a learning tool. *Procedia Economics and Finance*, 19, 287-295.
- Kop, R., & Hill, A. (2008). Connectivism: Learning theory of the future or vestige of the past? *International Review of Research in Open and Distance Learning*, 9(3), 1-14.
- Koranteng, F. N., Wiafe, I., & Kuada, E. (2018). An empirical study of the relationship between social networking sites and students' engagement in higher education. *Journal of Educational Computing Research*, 57(5), 1131-1159.
doi:10.1177/0735633118787528
- Kostova, Z., & Atasoy, E. (2008). Methods of successful learning in environmental education. *Journal of Theory and Practice in Education*, 4(1), 49-78.
- Krutka, D. G., Carpenter, J. P., & Trust, T. (2016). Elements of engagement: A model of teacher interactions via professional learning networks. *Journal of Digital Learning in Teacher Education*, 32(4), 150-158.

- Kurtz, G. (2014). *Students' perceptions of using Facebook group and a course website as interactive and active learning spaces*. Paper presented at the Proceedings of the 9th Chais Conference for the Study of Innovation and Learning Technologies: Learning in the Technological Era.
- Kuusisaari, H. (2014). Teachers at the zone of proximal development: Collaboration promoting or hindering the development process. *Teaching and Teacher Education*, 43, 46-57. doi:10.1016/j.tate.2014.06.001
- Labone, E., & Long, J. (2016). Features of effective professional learning: A case study of the implementation of a system-based professional learning model. *Professional Development in Education*, 42(1), 54-77.
- Lacey, A., & Luff, D. (2001). *Trent focus for research and development in primary health care: Qualitative data analysis*. Retrieved from http://med-fom-familymed-research.sites.olt.ubc.ca/files/2012/03/Trent_Universtiy_Qualitative_Analysis7800.pdf
- Lampe, C., Wohn, D. Y., Vitak, J., Ellison, N. B., & Wash, R. (2011). Student use of Facebook for organizing collaborative classroom activities. *International Journal of Computer-Supported Collaborative Learning*, 6(3), 329-347.
- Lasen, M., Skamp, K., & Simoncini, K. (2017). Teacher perceptions and self-reported practices of education for sustainability in the early years of primary school: An Australian case study. *International Journal of Early Childhood*, 49(3), 391-410. doi:10.1007/s13158-017-0200-x
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, England: Cambridge University press.
- Law, B. (2004). *Environmental education/Education for sustainability*. Paper presented at the Asia Pacific Environmental Education Research Seminar, Japan. <http://www.eec.miyakyo-u.ac.jp/APEID2004/pdf/Barry.pdf>
- Lawrence, M. J., Stemberger, H. L., Zolderdo, A. J., Struthers, D. P., & Cooke, S. J. (2015). The effects of modern war and military activities on biodiversity and the environment. *Environmental Reviews*, 23(4), 443-460.
- Leong, C., Pan, S. L., Bahri, S., & Fauzi, A. (2019). Social media empowerment in social movements: Power activation and power accrual in digital activism. *European Journal of Information Systems*, 28(2), 173-204. doi:10.1080/0960085X.2018.1512944
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: SAGE.
- Lincoln, Y. S., & Guba, E. G. (2003). *Ethics: The failure of positivist science*. Walnut Creek, CA: AltaMira Press.
- Littledyke, M. (1997). Science education for environmental education? Primary teacher perspectives and practices. *British Educational Research Journal*, 23(5), 641-659. doi:10.1080/0141192970230507

- Liu, K., Miller, R., & Jahng, K. E. (2016). Participatory media for teacher professional development: Toward a self-sustainable and democratic community of practice. *Educational Review*, 1-24. Retrieved from <https://www.tandfonline.com/doi/full/10.1080/00131911.2015.1121862>
- Lom, E., & Sullenger, K. (2011). Informal spaces in collaborations: Exploring the edges/boundaries of professional development. *Professional Development in Education*, 37(1), 55-74. doi:10.1080/19415257.2010.489811
- Loughland, T., Reid, A., Walker, K. I. M., & Petocz, P. (2003). Factors influencing young people's conceptions of environment. *Environmental Education Research*, 9(1), 3-19. doi:10.1080/13504620303471
- Lumpe, A., Czerniak, C., Haney, J., & Beltyukova, S. (2012). Beliefs about teaching science: The relationship between elementary teachers' participation in professional development and student achievement. *International Journal of Science Education*, 34(2), 153-166. doi:10.1080/09500693.2010.551222
- Lune, H., & Berg, B. L. (2016). *Qualitative research methods for the social sciences*. Boston, MA: Pearson.
- Maguire, M., & Delahunt, B. (2017). Doing a thematic analysis: A practical, step-by-step guide for learning and teaching scholars. *The All Ireland Journal of Teaching and Learning in Higher Education*, 9(3), 3351-33514. Retrieved from <http://ojs.aishe.org/aishe/index.php/aishe-j/article/viewFile/335/553>
- Mahdavi, P. (2014). *From trafficking to terror : Constructing a global social problem* (1 ed.). New York, NY: Routledge.
- Mailchimp. (2017). Retrieved from <http://kb.mailchimp.com>
- Mansfield, C., & Thompson, G. (2017). The value of collaborative rounds for teacher professional learning in Australia. *Professional Development in Education*, 43(4), 666-684. doi:10.1080/19415257.2016.1216883
- Manteaw, O. O. (2012). Education for sustainable development in Africa: The search for pedagogical logic. *International Journal of Educational Development*, 32(3), 376-383. doi:10.1016/j.ijedudev.2011.08.005
- Marcinkowski, T. J., Volk, T. L., & Hungerford, H. R. (1990). *An environmental education approach to the training of middle level teachers: A prototype programme*. Retrieved from Paris, France: http://www.unesco.org/education/information/pdf/333_52.pdf
- Marsick, V. J., & Watkins, K. E. (2001). Informal and incidental learning. *New directions for adult and continuing education*, 2001(89), 25-34.
- Marton, F. (1981). Phenomenography: Describing conceptions of the world around us. *Instructional science*, 10(2), 177-200.

- Marton, F. (1986). Phenomenography: A research approach to investigating different understandings of reality. *Journal of thought*, 21(3), 28-49. doi: <http://www.jstor.org/stable/42589189>
- Marton, F. (2000). The structure of awareness. In J. A. a. W. Bowden, Eleanor (Ed.), *Phenomenography* (pp. 102-116). Melbourne, Australia: RMIT University Press.
- Marton, F., & Pang, M. F. (2008). The idea of phenomenography and the pedagogy of conceptual change. In S. Vosniadou (Ed.), *International handbook of research on conceptual change* (PP. 533-559). NY, CA: Routledge.
- McConnell, T. J., Parker, J. M., Eberhardt, J., Koehler, M. J., & Lundeberg, M. A. (2012). Virtual professional learning communities: Teachers' perceptions of virtual versus face-to-face professional development. *Journal of Science Education and Technology*, 22(3), 267-277. doi:10.1007/s10956-012-9391-y
- McLaughlin, M. W., & Talbert, J. E. (2006). *Building school-based teacher learning communities: Professional strategies to improve student achievement* (Vol. 45). New York, NY: Teachers College Press.
- McLoughlin, C. (2011). *Reinventing the 21st century educator: Social media to engage and support the professional learning of teachers*. Paper presented at the Changing demands, changing directions: Ascilite 2011, Hobart, Australia. <http://www.ascilite.org/conferences/hobart11/proceedings.php>
- Meabon Bartow, S. (2014). Teaching with social media: Disrupting present day public education. *Educational Studies*, 50(1), 36-64. doi:10.1080/00131946.2013.866954
- Medrick, R. (2013). A pedagogy for sustainability education. *Journal of Sustainability Education*, 5. Retrieved from <http://www.susted.com/wordpress/>
- Merchant, G. (2012). Unravelling the social network: Theory and research. *Learning, Media and Technology*, 37(1), 4-19. doi:10.1080/17439884.2011.567992
- Merriam, S. B. (1988). *Case study research in education: A qualitative approach*. San Francisco, CA: Jossey-Bass.
- Mezirow, J. (2000). *Learning as transformation: Critical perspectives on a theory in progress*. San Francisco, CA: Jossey-Bass.
- Mfum-Mensah, O. (2011). Education collaboration to promote school participation in northern Ghana: A case study of a complementary education program. *International Journal of Educational Development*, 31(5), 465-471.
- Millennium Ecosystem Assessment. (2005). *Ecosystems and human well-being: Health synthesis*. Retrieved from <http://www.bioquest.org/wp-content/blogs.dir/files/2009/06/ecosystems-and-health.pdf>

- Ministry for the Environment. (1998). *Learning to care for our environment: A national strategy for environmental education*. Wellington, New Zealand: Ministry for the Environment.
- Ministry of Education. (1993). *New Zealand Curriculum Framework*. Wellington, New Zealand: Learning Media Limited.
- Ministry of Education. (1999). *Guidelines for environmental education in New Zealand schools*. Wellington, New Zealand: Learning Media Limited.
- Ministry of Education. (2007). *The New Zealand curriculum*. Wellington, New Zealand: Learning Media.
- Ministry of Education. (2016a). Education for Sustainability. Retrieved from <http://nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-sustainability>
- Ministry of Education. (2016b). Guidelines for Environmental Education in New Zealand Schools. Retrieved from <http://nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-sustainability/Tools-and-resources/Guidelines-for-Environmental-Education-in-New-Zealand-Schools>
- Ministry of Education. (2016c). Teacher toolbox for inquiring into practice. *Teaching as inquiry*. Retrieved from <http://nzcurriculum.tki.org.nz/Teaching-as-inquiry/Teacher-toolbox-for-inquiry>
- Ministry of Education. (2016d). Towards digital fluency. Retrieved from <https://www.education.govt.nz/assets/Uploads/Towards-Digital-Fluency.pdf>
- Ministry of Education. (2018). Teaching staff. *Education Counts*. Retrieved from https://www.educationcounts.govt.nz/statistics/schooling/teaching_staff
- Ministry of Education. (2019a). Communities of Learning | Kāhui Ako. Retrieved from <https://www.education.govt.nz/communities-of-learning/>
- Ministry of Education. (2019b). Google software for schools. Retrieved from <https://education.govt.nz/school/running-a-school/technology-in-schools/software/google>
- Mizell, H. (2010). *Why professional development matters*. Retrieved from www.learningforward.org/advancing/whypdmatters.cfm
- Moghavvemi, S., Sulaiman, A., Jaafar, N. I., & Kasem, N. (2018). Social media as a complementary learning tool for teaching and learning: The case of youtube. *International Journal of Management Education*, 16(1), 37-42. doi:10.1016/j.ijme.2017.12.001
- Mondahl, M., & Razmerita, L. (2014). Social media, collaboration and social learning: A case study of foreign language learning. *The Electronic Journal of e-Learning*, 12(4), 339-352.

- Musee, N. (2011). Nanotechnology risk assessment from a waste management perspective: Are the current tools adequate? *Human & Experimental Toxicology*, 30(8), 820-835. doi:10.1177/09603271110384525
- Nath, B. (2009). *Environmental Education and Awareness*. In B. Nath (Ed.), *Methods of environmental teaching and learning* (Vol. 1, pp. 356). doi:<https://www.eolss.net/Sample-Chapters/C11/E4-16-01-03.pdf>
- Neuman, W. L. (2006). *Social research methods: Qualitative and quantitative approaches* (Vol. 6th). Boston, MA: Pearson.
- New Zealand Government. (2016). NZ Curriculum to include digital technology. *beehive.govt.nz*. Retrieved from <https://www.beehive.govt.nz/release/nz-curriculum-include-digital-technology>
- New Zealand Post Primary Teachers' Association. (2013). *Professional learning and development (PLD)*. Retrieved from <https://www.ppta.org.nz/advice-and-issues/professional-learning-and-development-pld/>
- Ng, W. (2015). *New digital technology in education: Conceptualizing professional learning for Educators*. Switzerland: Springer.
- Nolet, V. (2015). *Educating for Sustainability : Principles and Practices for Teachers*. London, United Kingdom: Routledge.
- O'leary, Z. (2004). *The essential guide to doing research*. London, United Kingdom: SAGE.
- O'Leary, D. (2010). Outsider positioning in action research: Struggling with being on the outside looking in. In P. B (Ed.), *Undoing privilege: Unearned advantage in a divided world* (pp. 39-52). New York, NY: Zed Books.
- Opfer, V. D., & Pedder, D. (2011). Conceptualizing teacher professional learning. *Review of Educational Research*, 81(3), 376-407. doi:10.3102/0034654311413609
- Osborne-Gowey, J. (2014). What is social media. *Fisheries*, 39(2), 55-55. doi:10.1080/03632415.2014.876883
- Ostashewski, N., & Reid, D. (2010). *Networked teacher professional development: Applying the networked learning framework to online teacher professional development*. Paper presented at the EDGE 2010 e-Learning: The Horizon and Beyond Conference, St. John, Canada. <https://espace.curtin.edu.au/handle/20.500.11937/20442>
- Ostashewski, N. M., Reid, D., & Moisey, S. (2011). Applying constructionist principles to online teacher professional development. *The International Review of Research in Open and Distributed Learning*, 12(6), 143-156.
- Ötoker-Robe, I., & Podpiera, A. M. (2013). *The social impact of financial crises: Evidence from the global financial crisis* (Policy research working paper 6703). Retrieved from

<https://openknowledge.worldbank.org/bitstream/handle/10986/16912/WPS6703.pdf;sequence=1>

- Owen, S. (2014). Teacher professional learning communities: Going beyond contrived collegiality toward challenging debate and collegial learning and professional growth. *Australian Journal of Adult Learning*, 54(2), 54–77. doi:<https://eric.ed.gov/?id=EJ1033925>
- Pallant, J. (2010). *SPSS survival manual: A step by step guide to data analysis using SPSS*. New York, NY: Open University Press.
- Palmer, J. A. (2002). *Environmental education in the 21st century: Theory, practice, progress and promise*. London, United Kingdom: Routledge.
- Pang, M. F. (2003). Two faces of variation: On continuity in the phenomenographic movement. *Scandinavian Journal of Educational Research*, 47(2), 145-156. doi:10.1080/00313830308612
- Parr, J. (2009). *Organisational structure in New Zealand primary schools*. Retrieved from <http://www.educationalleaders.govt.nz/content/download/1561/13611/file/Judy%20Parr%20Sabbatical%20Report.pdf>
- Plauborg, H. (2009). Opportunities and limitations for learning within teachers' collaboration in teams: Perspectives from action learning. *Action Learning: Research and Practice*, 6(1), 25-34. doi:10.1080/14767330902731293
- Popescu, E. (2014). Providing collaborative learning support with social media in an integrated environment. *World Wide Web*, 17(2), 199-212.
- Punch, K. F. (2014). *Introduction to social research: Quantitative and qualitative approaches* (3rd ed.). Los Angeles, CA: SAGE.
- Rakhudu, M., Davhana-Maselesele, M., & Useh, U. (2016). Concept analysis of collaboration in implementing problem-based learning in nursing education. *Curationis*, 39(1), 1-13. doi:10.4102/curationis.v39i1.1586
- Rakow, S. J. (1985). A review of teacher inservice in environmental education: 1970–1980. *The Journal of Environmental Education*, 16(4), 7-10.
- Ramana, M. (2009). *Nuclear power: Economic, safety, health, and environmental issues of near-term technologies*. Retrieved from <https://www.annualreviews.org/doi/full/10.1146/annurev.environ.033108.092057>
- Räthzel, N., & Uzzell, D. (2009). Transformative environmental education: A collective rehearsal for reality. *Environmental Education Research*, 15(3), 263-277. doi:10.1080/13504620802567015
- Ravenscroft, A., Warburton, S., Hatzipanagos, S., & Conole, G. (2012). Designing and evaluating social media for learning: Shaping social networking into social

- learning? *Journal of Computer Assisted Learning*, 28(3), 177-182.
doi:10.1111/j.1365-2729.2012.00484.x
- Richardson, J. T. (1999). The concepts and methods of phenomenographic research. *Review of Educational Research*, 69(1), 53-82.
- Robertson, C. L., & Krugly-Smolka, E. (1997). Gaps between advocated practices and teaching realities in environmental education. *Environmental Education Research*, 3(3), 311-326.
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E. F., . . . Schellnhuber, H. J. (2009). A safe operating space for humanity. *Nature*, 461, 472-475. Retrieved from <https://www.nature.com/articles/461472a>
- Ross, C. R., Maninger, R. M., LaPrairie, K. N., & Sullivan, S. (2015). The use of Twitter in the creation of educational professional learning opportunities. *Administrative Issues Journal: Connecting Education, Practice, and Research*, 5(1), 55-76. doi:10.5929/2015.5.1.7
- Rutherford, C. (2013). Facebook as a source of informal teacher professional development. *In Education*, 16(1), 60-74.
doi:<https://ourspace.uregina.ca/handle/10294/3101>
- Sari, E. R. (2012). Online learning community: A case study of teacher professional development in indonesia. *Intercultural Education*, 23(1), 63-72.
- Schoenebeck, S. Y. (2014). *Giving up Twitter for lent: How and why we take breaks from social media*. Paper presented at the Conference on Human Factors in Computing Systems, Toronto, Canada.
http://yardi.people.si.umich.edu/pubs/Schoenebeck_SocialMediaBreaks14.pdf
- Schultz, P. W., Shriver, C., Tabanico, J. J., & Khazian, A. M. (2004). Implicit connections with nature. *Journal of Environmental Psychology*, 24(1), 31-42.
doi:10.1016/s0272-4944(03)00022-7
- Schwandt, T. A., Lincoln, Y. S., & Guba, E. G. (2007). Judging interpretations: But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation. *New directions for evaluation*, 2007(114), 11-25. doi:10.1002/ev.223
- Selwyn, N. (2012). Making sense of young people, education and digital technology: The role of sociological theory. *Oxford Review of Education*, 38(1), 81-96.
- Selwyn, N., Nemorin, S., & Johnson, N. (2017). High-tech, hard work: An investigation of teachers' work in the digital age. *Learning, Media and Technology*, 42(4), 390-405.
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2), 63-75. Retrieved from <http://waikato.summon.serialssolutions.com>

- Shin, K. H. (2008). *Development of environmental education in the Korean kindergarten context*. University of Victoria, Canada. Retrieved from <http://hdl.handle.net/1828/878>
- Sibona, C., & Choi, J. H. (2012). *Factors affecting end-user satisfaction on Facebook*. Paper presented at the International Conference on Weblogs And Social Media, Dublin, Ireland.
- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(1). Retrieved from https://web.archive.org/web/20190117053707/http://itdl.org/Journal/Jan_05/article01.htm
- Simmons, D. A. (1991). Are we meeting the goal of responsible environmental behavior? An examination of nature and environmental education center goals. *The Journal of Environmental Education*, 22(3), 16-21.
- Sitarz, D. (1993). *Agenda 21: The earth summit strategy to save our planet*. Boulder, CO: Earth Press.
- Sjoer, E., & Meirink, J. (2015). Understanding the complexity of teacher interaction in a teacher professional learning community. *European Journal of Teacher Education*, 1-16. doi:10.1080/02619768.2014.994058
- Smyth, J. C. (2006). Environment and education: A view of a changing scene. *Environmental Education Research*, 12(3-4), 247-264.
- Sobaih, A. E. E., Moustafa, M. A., Ghandforoush, P., & Khan, M. (2016). To use or not to use? Social media in higher education in developing countries. *Computers in Human Behavior*, 58, 296-305.
- Speth, J. G. (2003). Perspectives on the Johannesburg Summit. *Environment: Science and Policy for Sustainable Development*, 45(1), 24-29. doi:10.1080/00139150309604520
- Stamouli, I., & Huggard, M. (2007). *Phenomenography as a tool for understanding our students*. Paper presented at the International Symposium for Engineering Education, Dublin, Ireland. <https://www.asee.org>
- Stapp, W. B. (1969). The concept of environmental education. *Environmental Education*, 1(1), 29-31. doi:10.1080/00139254.1969.10801479
- Statista. (2019). The statistics portal. Retrieved from <https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/>
- Stokes, D., Evans, P., & Craig, C. (2017). Developing STEM teachers through both informal and formal learning experiences. *Ediciones Universidad de Salamanca*. Retrieved from <https://repositorio.grial.eu/handle/grial/919>

- Stoll, L., Bolam, R., McMahon, A., Wallace, M., & Thomas, S. (2006). Professional learning communities: A review of the literature. *Journal of Educational Change*, 7(4), 221-258. doi:10.1007/s10833-006-0001-8
- Sustainable Aotearoa New Zealand. (2009). *Strong sustainability for New Zealand: Principles and scenarios*. Retrieved from <http://www.nakedize.com/strong-sustainability.cfm>
- Taylor, A., & McQuiggan, C. (2008). Faculty development programming: If we build it, will they come? *Educause Quarterly*, 31(3), 28-37.
- Thacker, E. S. (2014). *Smooth sailing through stormy seas? High school social studies teachers navigating their informal professional learning*. (Doctor of Philosophy Doctoral dissertation). University of Kentucky, Lexington, KY.
- Tilbury, D. (1995). Environmental education for sustainability: Defining the new focus of environmental education in the 1990s. *Environmental Education Research*, 1(2), 195-212. doi:10.1080/1350462950010206
- Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2007). *Teacher professional learning and development: Best evidence synthesis iteration (BES)*. Wellington, New Zealand: Ministry of Education.
- Trust, T. (2012). Professional learning networks designed for teacher learning. *Digital Learning in Teacher Education*, 28(4), 133-138. doi:10.1080/21532974.2012.10784693
- Trust, T., Krutka, D. G., & Carpenter, J. P. (2016). "Together we are better": Professional learning networks for teachers. *Computers & Education*, 102, 15-34. doi:10.1016/j.compedu.2016.06.007
- Tur, G., & Marín, V. I. (2014). Enhancing learning with the social media: Student teachers' perceptions on Twitter in a debate activity. *New Approaches in Educational Research*, 4(1), 46-59. doi:10.7821/naer.2015.1.102
- UNEP. (2012). *21 issues for the 21st century: Results of the UNEP foresight process on emerging environmental issues*. Retrieved from Nairobi, Kenya: <http://wedocs.unep.org/handle/20.500.11822/8056>
- UNESCO. (1976). *The Belgrade Charter*. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000017772>
- UNESCO. (1977). *Education and the challenge of environmental problems*. Retrieved from Tbilisi, USSR.: <https://unesdoc.unesco.org/ark:/48223/pf0000028080>
- UNESCO. (1992). *Report of the United Nations conference on environment and development*. Retrieved from Rio de Janeiro, Brazil: <https://www.un.org/documents/ga/conf151/aconf15126-1.htm>
- UNESCO. (2002). *Education for Sustainability*. Retrieved from <http://unesdoc.unesco.org/images/0012/001271/127100e.pdf>

- UNESCO. (2005). *UNESCO and Sustainable Development*. Retrieved from <http://unesdoc.unesco.org>
- UNESCO. (2012). *Education for all: Beyond 2015. Mapping current international actions to define the post 2015 education and development agendas*. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000217935>
- UNESCO. (2014). UNESCO Education Strategy 2014–2021. Retrieved from <http://unesdoc.unesco.org>
- United Nations. (1992). *Agenda 21*. Paper presented at the The Earth Summit: United Nations Conference on Environment & Development, Rio de Janeiro, Brazil. <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf>
- Van Schalkwyk, S., Leibowitz, B., Herman, N., & Farmer, J. (2015). Reflections on professional learning: Choices, context and culture. *Studies in Educational Evaluation*, 46, 4-10. doi:10.1016/j.stueduc.2015.03.002
- Visser, R. D., Evering, L. C., & Barrett, D. E. (2014). #TwitterforTeachers: The implications of Twitter as a self-directed professional development tool for K–12 teachers. *Journal of Research on Technology in Education*, 46(4), 396-413. doi:10.1080/15391523.2014.925694
- Vivian, R., Falkner, K., & Falkner, N. (2014). Addressing the challenges of a new digital technologies curriculum: MOOCs as a scalable solution for teacher professional development. *Research in Learning Technology*, 22. doi:10.3402/rlt.v22.24691
- Vygotsky, L. S. (1978). *Mind in society: The development of higher mental process*. Cambridge, MA: Harvard University Press.
- Wahyuni, D. (2012). The research design maze: Understanding paradigms, cases, methods and methodologies. *Journal of Applied Management Accounting Research*, 10(1), 69-80.
- Wals, A. E. (1990). Caretakers of the environment: A global network of teachers and students to save the earth. *The Journal of Environmental Education*, 21(3), 3-7.
- Warner, A., Eames, C., & Irving, R. (2014). Using social media to reinforce environmental learning and action taking for school students. *International Electronic Journal of Environmental Education*, 4(2), 83-96.
- Watson, S. (2013). *Understanding mathematics teachers' professional development from the perspective of social learning theory*. Paper presented at the 8th Congress of European Research in Mathematics Education, Antalya, Turkey. https://www.educ.cam.ac.uk/people/staff/watson/Watson_CERME8_2013_Proceedings.pdf
- Wayne, A. J., Yoon, K. S., Zhu, P., Cronen, S., & Garet, M. S. (2008). Experimenting with teacher professional development: Motives and methods. *Educational Researcher*, 37(8), 469-479.

- White, G. K. (2013). *Digital fluency: Skills necessary for learning in the digital age*. Retrieved from http://research.acer.edu.au/digital_learning
- Wilke, R. J., Peyton, R. B., & Hungerford, H. R. (1987). *Strategies for the training of teachers in environmental education*. Retrieved from Paris, France: http://www.unesco.org/education/pdf/333_35.pdf
- Witmer, D. F., Colman, R. W., & Katzman, S. L. (1999). From paper and pencil to screen and keyboard. In S. Jones (Ed.), *Doing internet research: Critical issues and methods for examining the net* (pp. 145-161). Thousand Oaks, CA: SAGE.
- Yang, H. H., & Yuen, S. C.-Y. (Eds.). (2010). *Collective intelligence and E-learning 2.0: Implications of web-based communities and networking*. Hershey, PA: Information Science Reference.
- Yavetz, B., Goldman, D., & Pe'er, S. (2013). How do preservice teachers perceive 'environment' and its relevance to their area of teaching? *Environmental Education Research*, 20(3), 354-371. doi:10.1080/13504622.2013.803038
- Zhang, S., Liu, Q., Chen, W., Wang, Q., & Huang, Z. (2017). Interactive networks and social knowledge construction behavioral patterns in primary school teachers' online collaborative learning activities. *Computers & Education*, 104, 1-17. doi:<https://www.sciencedirect.com/science/article/pii/S036013151630197X?via%3Dihub>
- Zhao, X., Lampe, C., & Ellison, N. B. (2016). *The social media ecology: User perceptions, strategies and challenges*. Paper presented at the CHI conference on human factors in computing systems, San Jose, CA. <https://dl.acm.org/citation.cfm?doid=2858036.2858333>

Appendices

Appendix A: Questionnaire (Phase one)

Dear teachers

I am interested in your perceptions and experiences of using social media in your professional learning and improving teaching practice in environmental education (EE, also known as EfS). In this study, teacher professional learning

(TPL) is any kind of activity by teachers which aims to enhance their teaching work. Social media here refers to digital and open platforms, where collaborative interactions between users can occur through a network(s), such as Facebook, Twitter, YouTube, and Instagram.

I would be grateful if you would assist me by completing the survey questions. Your participation is voluntary and can choose to not answer any or all questions. Please answer questions as honestly as possible. All the information you provide will remain confidential and will only be used for research purposes, and in publications related to this research. Please do not include your name or other information that might personally identify you in any of your responses.

Fariba Mostafa

A. Please provide the following information about yourself.

1. Gender: (please select one by clicking on the button)

1.1. Female

1.2. Male

1.3. Other

2. Age: (please select one)

2.1. 20- 29

2.2. 30-39

2.3. 40-49

2.4. 50-59

2.5. 60 and above

B. please provide following information about your work as a teacher.

3. In which educational setting do you currently work? (Please select one)

3.1. Early Childhood Centre

3.2. Primary school

3.3. Intermediate/middle school

3.4. Secondary school

3.5. Composite/area school

3.6. Special school

3.7. Other (please specify)

4. How long have you been working as a teacher? (Please select one)

4.1. Less than 5 years

4.2. 5-9 years

4.3. 10- 19 years

4.4. More than 20 years

5. How long have you been involved in teaching EE? (Please select one)

5.1. Less than 5 years

5.2. 5-9 years

5.3. 10- 19 years

5.4. More than 20 years

6. How confident do you feel to teach EE? (Please select one)

6.1. Not confident at all

6.2. Not very confident

6.3. Neither confident or unconfident

6.4. Moderately confident

6.5 Very confident

		At work	Outside of work
7.1	Desktop computer		
7.2	Laptop computer		
7.3	Tablet/iPad		
7.4	Mobile phone		

C. Please indicate the following information about your social media usage.

7. Which of the following devices do you use to engage with social media and where do you use them? (Please select any that apply)

8. Which of these social media platform(s) do you.....

		None	Facebook	Twitter	Pinterest	Google+	Instagram	YouTube	Other
8.1	Currently use <u>the most</u> for any purpose? (please select one)								
8.2	Currently use <u>for learning</u> of any kind? (please tick any that apply)								
8.3	Currently use for your <u>professional learning</u> ? (please tick any that apply)								

8.4	Currently use for your professional learning in EE specifically? (please tick any that apply)								
8.5	Suggest would be useful to establish a new professional learning network for teachers who engage in EE? (please tick any that apply)								

9. How frequently do you do the following activities on social media? Please read each statement and select only one frequency.

		Never	Rarely	Sometimes	Often	Very often
9.1	Keeping in touch with friends and family	0	1	2	3	4
9.2	Networking with colleagues	0	1	2	3	4
9.3	Learning in general	0	1	2	3	4
9.4	Professional learning	0	1	2	3	4
9.5	Professional learning in environmental education	0	1	2	3	4

D. Please provide your perception of your experiences of teacher professional learning in EE.

10. Please rate the following teacher professional learning methods for their effectiveness in improving your knowledge and skills specifically for your work as a teacher of EE, by choosing the appropriate number in the boxes below. Please choose not applicable, if you haven't used the method specifically for your work as a teacher of EE.

		Not applicabl e	Ineffective	Somewh at effective	Very effecti ve
10.1	Asking questions of environmental education experts in any setting	0	1	2	3
10.2	Formal study towards a qualification (e.g. a degree programme)	0	1	2	3
10.3	Participation in a network of EE colleagues through social media	0	1	2	3
10.4	Visiting other schools to see what they are doing in EE	0	1	2	3
10.5	Informal face to face discussions with colleagues	0	1	2	3
10.6	Learning by yourself (any form of self-learning)	0	1	2	3
10.7	Observation of other teachers' practices	0	1	2	3
10.8	Formal face to face courses, workshops/hui	0	1	2	3
10.9	Staff meetings or teacher only days	0	1	2	3
10.10	Education conferences	0	1	2	3
10.11	Field trips	0	1	2	3
10.12	Others (please specify)	0	1	2	3

11. For the teacher professional learning in EE methods in Question 9, based on your perception, please rank your top 4 preferred methods by writing number 1 alongside your most preferred method, number 2 alongside your second most preferred, number 3 for your third preferred method and number 4 for the fourth preferred method.

		Rank
11.1	Asking questions and discussion with environmental education experts	
11.2	Formal study towards a qualification (e.g. a degree programme)	
11.3	Participation in a network of teachers through social media	
11.4	Visiting other schools to see what they are doing in EE	
11.5	Informal face to face discussions with colleagues	
11.6	Learning by yourself (any form of self-learning)	
11.7	Observation of other teachers' practices	
11.8	Formal face to face courses, workshops/hui	
11.9	Staff meetings or teacher only days	
11.10	Education conferences	
11.11	Field trips	
11.12	Other (as you specified in Q10)	

12. From your perception and/or experiences, how do you rate the importance of the following features of professional learning opportunities in EE? Please select only one option per feature.

		Very low	Low	Moderate	High	Very high
12.	Focused on improving student learning	1	2	3	4	5
12.2	Focused on improving teachers' knowledge in environmental issues	1	2	3	4	5
12.3	Focused on developing teachers' skills to engage in EE	1	2	3	4	5
12.4	Flexible in terms of time and place	1	2	3	4	5
12.5	In line with teaching as inquiry	1	2	3	4	5

12.6	Available on demand	1	2	3	4	5
12.7	Free of charge	1	2	3	4	5
12.8	Collaborative	1	2	3	4	5
12.9	Ongoing	1	2	3	4	5
12.10	Curriculum linked	1	2	3	4	5
Please suggest any other features of TPL which you think is important.						

13. Please indicate the extent to which you agree or disagree with the following statements by selecting the appropriate response for each statement.

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
13.1	To achieve sustainability, it is important that all students engage with sustainability issues.					
13.2	To facilitate EE, I believe teachers need to develop knowledge of environmental and sustainability issues.					
13.3	To facilitate EE, I believe teachers need to be able to explore values associated with environmental and sustainability issues with their students.					
13.4	To engage students in EE, I believe teachers need to know how to facilitate student decision making and taking action towards sustainability					

E. Please indicate your view about TPL in EE through social media.

14. Please indicate the extent to which you agree or disagree with the following statements by choosing the appropriate answer in the boxes below.

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
14.1	Social media can be useful for educational purposes.	1	2	3	4	5
14.2	Social media can be useful for learning about environment and sustainability.	1	2	3	4	5
14.3	Social media can be useful for teachers' collaborative learning in EE.	1	2	3	4	5
14.4	Social media can be useful for EE teachers to provide learning support for their colleagues.	1	2	3	4	5
14.5	Social media can be useful for observation of peer practice in EE.	1	2	3	4	5
14.6	Social media can help to build a professional learning network of EE teachers.	1	2	3	4	5
14.7	EE teachers should be using social media for their learning today.	1	2	3	4	5
14.8	Using social media for professional learning enables EE teachers to contribute towards digital literacy in the NZ curriculum	1	2	3	4	5
14.9	Social media could help EE teachers feel less isolated in this work.	1	2	3	4	5

15. On a scale of 1-10 with 10 being the most useful, how would you rate social media's potential for your professional learning in EE? Please select the number that best expresses your view by dragging the circle slider below.

Not useful at all 1 2 3 4 5 6 7 8 9 10 extremely useful

16. Please explain your answer for question 15.

17. On the scale of 1-10 with 10 extremely likely, if there was a new social media network available for NZ teachers engaged in EE, how likely are you to join it? Please select the number that best expresses your view by dragging the circle slider below.

Not at all likely 1 2 3 4 5 6 7 8 9 10 extremely likely

18. Please clarify what a new social media learning network could provide for you?

19. What are your concerns, if any, about professional learning through social media in EE?

20. Please add any final thoughts about teacher professional learning in EE through social media.

21. Overall, what is your preferred teacher professional learning method in EE? (Tick only one)

19.1. Face to face

19.2. Learning through digital technology (internet, social media, apps)

19.3. Combination of face to face and using digital technology

Other (please specify)

Thank you for your time.

I appreciate your valuable feedback very much. If you would be prepared and willing to help me further in the next phase, in an interview focusing on your experiences of using social media for your professional learning, and teaching practice in EE, please indicate your interest by replying to my email which will be sent to you through fm61@students.waikato.ac.nz, and I will follow up to set up the next phase of your involvement.

I deeply value your contribution.

Fariba

Appendix B: Email to Enviroschool lead teachers (Phase one)

Dear teachers

I invite you to participate in an online survey as part of a research study for my PhD programme at the University of Waikato. The purpose of this study is to learn about teachers' perceptions of using social media for their own professional learning in environmental education (EE). The research is being conducted under the supervision of Dr Chris Eames and Dr Dianne Forbes.

I appreciate that you are very busy and thank you in advance if you are able to spare the time to help with this important research. The survey may take up to 15 minutes to complete. Your participation in this research is completely voluntary. If you do not wish to answer any question, you may skip it and move on to the next question. The survey is completed anonymously, and your responses will be confidential. The findings may be included in my thesis which will be lodged in the University of Waikato Research Commons when it is completed. Also, a summary of survey findings will be made available to you through the Enviroschools Programme.

If you have any questions, or need more details about this research, please contact me, Fariba Mostafa, fm61@students.waikato.ac.nz, 0211417392. If I am unable to resolve your concerns, you may contact my supervisor, Dr Chris Eames, c.eames@waikato.ac.nz, 078384357. I invite to respond to this survey by clicking the link below:

URL for survey link

Yours sincerely

B.1. Email to Enviroschool lead teachers (Phase one) – First Reminder

Dear teacher

You may have already received the e-mail inviting you to participate in the environmental education survey (Teachers' perceptions of professional learning through social media in environmental education). If you have already completed and returned this questionnaire, please accept my thanks for your time and interest. If you haven't completed the questionnaire, please take the time to consider helping me with this important research. I am inviting you to complete an online questionnaire about your perceptions and experiences of using social media in your professional learning and for improving your teaching practice in environmental education (EE, also known as EfS). This survey questionnaire is part of a research study for my PhD programme at the University of Waikato. The research study is being conducted under the supervision of Dr Chris Eames and Dr Dianne Forbes.

Your valuable participation will contribute towards improving the quality of teacher professional learning (TPL) in EE. The questionnaire is strictly anonymous, and your responses will be confidential. However, your participation in this research is completely voluntary. If you do not wish to answer any question, you may skip it and move on to the next question. The findings may be included in my thesis which will be lodged in the University of Waikato Research Commons when it is completed. Also, a summary of survey findings will be made available to you through the Enviroschools Programme. If you have any questions or need more details about this research, please contact me, Fariba Mostafa, fm61@students.waikato.ac.nz, 0211417392. If I am unable to resolve your concerns, you may contact my supervisor. Dr Chris Eames, c.eames@waikato.ac.nz, 078384357.

The survey should take no longer than 15 minutes to complete. Also, please note that you are not able to save your responses and return to the survey at a later stage. To begin the questionnaire, please click on the link below. Thank you for giving your time to help me with this research. If you would be in further discussing your views and experiences of using social media for your professional learning and teaching practice in EE, please

indicate your interest to be involved in an interview of up to 30 minutes by emailing me at fm61@students.waikato.ac.nz.

URL for survey link

Yours sincerely

Fariba Mostafa

B.2. Email to Enviroschool lead teachers (Phase one) – Second Reminder

Dear teacher,

One month ago you may have received an email with a questionnaire seeking your perceptions and/or experiences of your professional learning through social media in environmental education. If you have already completed and submitted this questionnaire, thank you so much for your time. The responses on this survey have provided some very useful and interesting data. The survey will remain open until Friday 7th April to capture your particular experiences and perceptions which could help in improving teacher professional learning in EE.

This survey questionnaire is part of a research study for my PhD programme at the University of Waikato. The research study is being conducted under the supervision of Dr Chris Eames and Dr Dianne Forbes. Your participation in this research is voluntary. If you do not wish to answer any question, you may skip it and move on to the next question. The questionnaire is strictly anonymous, and your responses will be confidential. The findings may be included in my thesis, which will be lodged in the University of Waikato Research Commons when it is completed. Also, a summary of survey findings will be made available to you through the Enviroschools Programme. If you have any questions or need more details about this research, please contact me, Fariba Mostafa, fm61@students.waikato.ac.nz, 0211417392. If I am unable to resolve your concerns, you may contact my supervisor. Dr Chris Eames, c.eames@waikato.ac.nz, 078384357.

The survey should take no longer than 15 minutes to complete. Also, please note that you are not able to save your responses and return to the survey at a later stage. To begin the

questionnaire, please click on the link below. Also, if you would be prepared and willing to help me further in the next phase, in an interview focusing on your perceptions, perspectives and/or experiences of using social media for your professional learning and teaching practice in EE, please indicate your interest by emailing me at fm61@students.waikato.ac.nz and I will follow up to set up the next phase of your involvement.

URL for survey link

Yours sincerely

Fariba

Call for participation (Phase two)

Dear Teacher

We recently conducted a survey seeking your perceptions and/or experiences of your professional learning in environmental education (EE) through social media as part of a wider research project. More than 190 of teachers contributed to this questionnaire. I would like to thank those teachers who participated for taking the time to complete the survey and providing such a rich data which will help inform future teacher professional learning (TPL) in EE. A comprehensive summary of survey findings will be available to you through the Enviroschools Programme when it is completed. However, I would like to share some of the emerging findings.

The survey found that most teachers are concerned about environmental and sustainability issues. Many participants are willing to improve their environmental knowledge, while the large proportion stated that they feel confident teaching EE. Participants also pointed out that they are looking for new ideas, collaborative learning, and support through social media. In this regard, 171 respondents stated that they currently use social media for their professional learning in EE.

Many teachers are concerned about time, support, privacy, school resources, the reliability of online information, and losing the opportunity for face to face collaboration. Survey findings also point out that teachers are looking for a balance between traditional TPL and learning through social media. Accordingly, 65% of participants indicated that combination of face to face and learning through social media is their preferred learning

method. Many respondents suggested that a well-managed social media platform would be a means for TPL in EE. The majority of participants indicated their interest to participate in a TPL network. And last, but not least, some of the teachers identified social media as a learning distraction, not a learning tool.

I am now conducting interviews to explore teacher concerns and thoughts more deeply about how social media can contribute to TPL in EE. I am interested to talk to both those teachers who use, and those who do not use, social media for professional learning in EE or/and teachers who have never used social media at all. I have received emails from some of the teachers who indicated they are willing to participate further in interviews but I would be pleased to speak with more. If you would be prepared and willing to participate, please indicate your interest by emailing me at fm61@students.waikato.ac.nz and I will follow up to set up your involvement, considering that the interview takes around 20-30 minutes and you can suggest a day and time that suits you.

Thank you again for your time and participation

Sincerely

Fariba

Appendix C: Interview questions Phase two

Introduction

Date and time:

Interview type:

Interviewee:

Section I: background questions and information about the teachers' work

1. Please tell me about yourself:

Your name, what age range are you in, how long have you been working as a teacher, How long have you been involved in teaching environmental education, in which educational setting do you currently work?

Section II: EE in their school and in the New Zealand curriculum

2. Can you tell me what environmental education in your school involves?

Follow up: can you tell me how you engage in environmental education at school?

Follow up: Are there any other ways you engage in environmental education when you are not in school?

3. How do you see the importance of environmental education in New Zealand education system?

Section III: participants' perceptions and experiences of TPL in EE

4. What is your opinion of professional learning opportunities available currently in environmental education?

Follow up: How do you think teacher professional learning could help to improve environmental education in new Zealand?

5. What professional learning have you had in environmental education?

6. What professional learning opportunities would you prefer in environmental education and why?

7. How might this teacher professional learning in environmental education help you in your teaching?

8. What do you think about teacher collaboration in environmental education? (or in any setting or field).

9. What are your experiences of collaborative learning (or working with other teachers) in environmental education? (Or in another setting, field, etc..).

Section IV: Information on social media usage in general and learning through social media, particularly in EE

10. Do you have any social media account(s)? Which social media account(s) do you have?

11. How often do you use it? Do you use it for learning? Why do you use it for learning?

12. What do you know about teacher collaboration through social media in environmental education?

13. Have you used social media for your professional learning in environmental education? If answer is yes: Was this of any help for you? Can you tell me why and how you use social media for your professional learning in environmental education and explain further? Which platform(s) do you use for your professional learning in environmental education? Why?

If answer is no: Can you tell me why don't use social media for your professional learning in environmental education and explain further? Have you heard or seen other colleagues learn through social media in environmental education? How do you think this works (or doesn't work) for them?

14. To what extent would you be interested in using social media for your professional learning in environmental education? Under what conditions?

15. What value do you perceive in learning through social media in environmental education?

Section V: clarifying the findings from the questionnaire

16. Findings that emerged from the environmental education survey indicated that many environmental education teachers are concerned about finding enough time to do professional learning through social media. What is that like for you? Follow up: to what extent might the time it takes to learn through social media an issue for you?

17. Looking at the data from the environmental education survey, many of the participants indicated that they are looking for new ideas through social media. Would you look for new ideas through social media in environmental education? If so, what would you be looking for?

18. The survey findings also showed that environmental education teachers are looking for support through social media. Would this apply to you? If so, what kind of support would you be looking for through social media in the context of environmental education?

VI. Teacher professional learning through social media

19. If you were invited to join a teacher professional learning network or a programme through social media in environmental education, what would you be hoping for? For instance, what would be your priority? What platform(s) would you choose? Why? Are there any particular topics or areas in environmental education that would interest you and motivate you to use social media to interact with other teachers.

20. Do you perceive any difficulties or challenges in using social media for professional learning in environmental education? If so, what?

What are your final thoughts about teacher professional learning through social media in EE?

Appendix D: Call for participation (Phase three)

Kia ora

We recently conducted a survey and some interviews seeking teacher perceptions and/or experiences of their professional learning in EE through social media as part of a wider research project. Findings indicated that while teachers perceive various advantages in learning through social media, they are concerned about some challenges as well. Considering suggested possible strategies to overcome those challenges, we are planning to establish a network for EE teachers through social media as a pilot study.

Now we are looking for volunteers to take part in a teacher professional learning network through social media in EE. The network will enable synchronous and asynchronous communication and interaction between secondary teachers in different places. Prior to learning through a network, participants and the researchers will have an online meeting to discuss the implementation of findings to create a network. The online meeting would provide participants with the opportunity to get to know other members of the learning network and to share their concerns and ideas. The focus for learning in the network will be agreed by participants but may include EfS Achievement Standards or specific topics such as climate change or water quality.

Your participation is invaluable at this stage of my research. If you are interested in being involved in this pilot study and seeing what a social media network could do for your professional learning, please email me at fmostafa@waikato.ac.nz.

Kind regards

Fariba

Appendix E: The EEfS Google+ strategy (Phase three)

About EEfS

Environmental education for sustainability (EEfS) is a learning community involving a group of environmental education (EE) teachers and experts that operates as a collaborative network via Google+. This pilot study is the last phase of a wider research study about teachers' perceptions and experiences of professional learning through social media in EE. This learning community has been created based on strategies suggested by research participants in previous phases of this study. Findings from these phases indicated that teachers perceived the usefulness of social media as enabling teachers to access support networks and resources with no limitations on time and place. A recurring idea was a sense amongst teachers that learning through social media is helpful if it operates through a user-friendly platform and straightforward network. The findings also showed that teachers were concerned about some challenges related to learning through social media such as privacy of participants and accuracy of information. As social media is a source of distraction and time consuming, many teachers were worried about spending time on social media for learning purposes. Another reason for not using social media in their professional learning can be that teachers cannot see a professional use for it when it is commonly used for personal purposes. For example, Facebook has the highest number of users for daily social interactions and entertainment. Based on these findings and a number of suggestions and possible strategies were given by participants, Google+ is used in this pilot study to connect EE teachers and experts through a community called EEfS.

Why Google+

To keep personal and professional learning networks separate (e.g. Facebook is popular for personal use).

To follow methodological approaches in this phase of the research study (Google+ is suggested by teachers who are voluntary participants in the study).

To mitigate social media barriers through utilizing a closed group for EE teachers.

To have less distraction (it is easy to get distracted on Facebook or Twitter due to the number of posts and users).

To create conversation opportunities as interpersonal discussion is not an option on visual social media networks such as Instagram and Pinterest.

To use google apps functionality that is available to teachers (Google+ is part of Google Apps).

To use a platform which teachers are familiar with (Google+ is widely used by NZ schools).

Key principles of this learning community

Connection and collaboration between EE teachers and experts, in order to increase teachers' knowledge regarding environmental education and enhance their teaching practice.

What can this learning community provide for teachers?

Based on teachers' suggestions, EEfS could provide teachers with access to a wide range of ideas and resources. Through networking, teachers would be able to stay up-to-date on important changes in the field of EE as well as news, events and available courses, conference or learning opportunities. There are different ways that teachers could learn through EEfS, including access to information; teaching and learning resources; communicating with other teachers or experts; discussion; and collaboration. EEfS could provide opportunities for EE teachers to connect with others, share ideas and resources, reflect critically on their practice, and create new knowledge about teaching and learning. Participation in this learning network also would provide teachers with an opportunity for ongoing and self-directed professional learning.

EEfS community aims:

To build connections between EE teachers and experts, which could help teachers to overcome the challenges of integrating EE into school curricula.

To facilitate collaborative learning for EE teachers regarding teaching EfS standards especially at senior levels.

To increase teachers knowledge regarding the environment and enhance their teaching practice, which in turn could positively effect students' learning toward sustainability.

The research aims in phase 3:

To use the research findings in order to establish a social media network for teacher professional learning in EE.

To operate a social media network based on the findings from previous phases of the study.

To mitigate teachers' challenges regarding learning through social media, by utilizing Google+ and having a closed community specifically for EE teachers.

To investigate teachers' activities, wants and needs regarding learning through social media.

To study teachers' views of professional learning in EE, through a particular social media network of EE teachers.

To find out how a group of teachers who engage in learning through a community on Google+ believe this learning may have impacted upon their teaching practices.

To explore how teachers perceive the potential of Google+ and/or social media for use in TPL in EE.

Participants, who contribute in this community, are expected:

To work towards a shared goal, which is enhancing teachers' practice regarding EfS achievement standards.

To discuss ways in which they would teach an EfS unit in first semester 2018.

To contribute to the discussion regarding teaching EfS standards or a particular EfS unit.

To be involved in collaboration with other teachers and experts in the field of EE.

To be active members of a network for professional learning in EE.

To participate in EEfS community activities including posting, discussion, and communication.

To get advice, feedback and support, and provide the same to other members.

Duration of the study

The study would run throughout term one 2018. It would require preparations including members' discussions regarding an EfS unit to teach, and the provision of materials for teaching. The total duration overall would therefore be from the beginning of November 2017 until the end of April 2018.

EEfS as a pilot study

This Google+ learning community will operate as part of a wider research project into EE. Therefore, all posts and activities will be considered as research data and I will check all posts weekly to find how this community works for teachers. Community members' posts and activities will be analyzed, interpreted, summarised, and used for research purposes, and in publications related to this research. At the end of the first term, in-depth interviews (semi-structured) will be conducted as the main method for data collection. This final interview will revolve around issues of participants' experiences with EEfS professional learning community and the extent to which they believe collaboration with other colleagues and professionals through social media has impacted on their learning and/or enhanced their teaching practice in EE. Participants will be informed about ethical considerations and their rights through an information sheet and a consent form. Also, participants will be informed that every reasonable effort will be made to ensure their anonymity. For example, use of pseudonyms in published research.

Intellectual property

Using the works of other teachers, such as lesson plans, term plans, or any innovation in teaching needs permission from the creator or owner of the work. Fair use of a particular

item in teaching or other purposes will be discussed with the community, and will be sought when needed.

The moderator's responsibility

The moderator is responsible:

For operating the community as an ongoing and collaborative learning community. Therefore, weekly and monthly discussions with members are needed.

For undertaking different methods and activities to make the platform and discussion interesting, updated and in line with EfS standards.

For running the community in line with the research study's aims and methodological approach.

For encouraging participants collaborations toward learning.

For making interventions to influence the direction of community debates on EEfS subjects.

For acknowledging the member's activities.

For initiating communication and discussion in line with EfS topics such as through asking questions, sharing news with the community or introducing a topic.

For offering assistance including how to use Google+, as well as accessing and updating information and resources.

For providing a holistic strategy for the community.

For setting a weekly plan based on teachers' interests, wants and needs.

For arranging monthly webinars.

For discussing with community members at the end of each month, in order to plan for the following month.

For sharing relevant news.

For informing members about social and educational events, conferences and environmental activities.

For finding out and sharing activities on similar networks, in order to provide points of comparison and encouragement.

The strategy, which will be used in this community, is shown in Table 1. However, most of the activities will be ongoing as new members might join the community. Also, in line with the methodological approach in this study, topics and activities for each month will be chosen based on teachers' suggestions. This is a preliminary plan for the development of an interactive community based on teachers' perceptions. The exact strategies for this community cannot be prescribed in advance, as all topics and activities are based on teachers' perspectives. Therefore, I will set monthly and weekly strategies after talking to the community members.

Week	Topic(s)	Activity	Description of the moderator's activity
Week 1	Introduction	Encouragement	Asking everyone to introduce himself or herself and talk about their interests.
Week 2	Feedback on introduction	Acknowledgement	Providing feedback to the members' introductory comments and their interests
Week 3	Teachers' interests regarding EE	Initiation	Finding out about the teachers' interests in terms of teaching EE.
Week 4	Feedback & discussion	Acknowledgement & Encouragement	Acknowledging teachers' comments, and encouraging teachers and experts to discuss further about teachers' interests in EE
Week 5	Integrating EE in school curriculum	Question, answer, and Discussion	Questioning about how EE can be integrated into other subject areas

Week 6	Feedback & Follow-up	Initiation & Discussion	Inviting all members to contribute to this discussion by responding to some questions
Week 7	Rising the community	Intervention	Inviting all members to the challenge of inviting another EE teacher to the community
Week 8	Planning for summer	Encouragement, collaboration & Initiation	Organising webinars to discuss strength and weakness of the community, planning for activities during summer and setting future targets
Week 9	follow-up and finalizing the plan	Acknowledgement, collaboration and planning	Reviewing members' views by providing a summary of meetings, encouraging them to add any viewpoints and providing a plan for following month
Week 10	Suggested topic	Initiation	Opening the conversation by asking a question
Week 11	Feedback, follow-up, and conclusion	Encouragement, Acknowledgement & discussion	Providing feedback to the members' posts, encouraging others to contribute to the discussion, and reviewing and collaborating in relation to the discussion
Week 12	Planning and choosing topic		Organising webinars with experts

The preliminary strategy for EEfS community

How to use Google+

Setting up a G+ profile is like setting up any other social media account. However, since we would use it only for professional learning proposes, there are a few practices to follow. To start using Google+ for learning:

1. Set up a Google+ account with your real name, or your professional name.
2. Add a profile picture, which represents you as a professional. For instance, an actual picture of you, which is professionally appropriate.
3. Add some basic information, for example, the region and city you work in.


4. Join the community by accepting the invitation (you will receive the invitation to join EEfS community via your Gmail account).

5. The following link will take you to a page, which explains about Google+. This Google+ tutorial covers everything you need to know about using Google+.

<https://www.wikihow.com/Use-Google%2B>

6. If you have any questions or concerns about using Google+ for community activities I will assist you as the community moderator.

Appendix F: EEfS Google+ post



Fariba Mostafa Owner

Jun 24, 2018

⋮

► **Environmental education for sustainability** ✓

Kia ora Community

I would like to thank all of you for taking part in EEfS community. I appreciate your time, participation, involvement and support.



As you know, your participation in this community is part of a large PhD research study into teachers' perceptions of professional learning through social media in environmental education. We have used the findings from previous phases of this research to set up a learning community for teachers involved in EEfS achievement standards and to offer a place and opportunities to learn, share and communicate. Achieving the community's goals while conducting research effectively have been our concerns. Despite the challenges, the EEfS community offers tremendous potential for professional learning which could assist teachers.

The time for this phase of the study has ended and it is time to move on to the next step of this research. I am now planning to conduct interviews to explore your perceptions, concerns and thoughts regarding learning through social media in EE based on your experiences as an EEfS Google+ member. I am interested to talk to both those teachers who actively engaged, and those who do not engage in the EEfS learning community. The interview invitation will be sent via email.


Through the EEfS Google+ community, you were introduced to new ways of professional learning in EE. As part of the community activities, we have run monthly webinars to support your professional learning. If you have found the webinars useful for your professional learning, we are happy to continue these for a few more months at least or for as long as there is interest.

If you have any suggestions for how the Google+ community might continue, please let me know.

Thank you again for your time and participation



Shared privately



Add a comment...

Appendix G: Ethics application approval

From: **Ethics Application** <fedu.ethics@waikato.ac.nz>

Date: Fri, Aug 5, 2016 at 6:12 PM

Subject: FEDU Ethics Application Approved

To: Fariba Mostafa <fm61@students.waikato.ac.nz>

The following is an automated email sent from the Ethics Review Application.

Congratulations **Fariba Mostafa** your ethics application “**Teachers' perceptions of using social media in teacher professional learning in environmental education**” has been approved.

Appendix H: Information sheet and consent form (Phase two)

Dear Teacher

Thank you for completing the online survey as part of a research study for my PhD programme at the University of Waikato. Thank you also for indicating your interest in being interviewed.

I would like to invite you now to participate in the interview, which I expect to last 20-30 minutes. The interview would be an online (Skype, FaceTime, or any Apps which you feel more comfortable using it) or telephone interview based on your suggestion. I would like to audio-record our conversation, with your agreement, so that I can analyse our conversation later. The information recorded will be confidential and no one except me will have access to it. I will then provide you with a transcription of the interview, for you to check for accuracy and to make any changes to what you have said within two weeks of receiving it and then returning to me by email.

Your participation in this research is completely voluntary, and you can decline to be involved further in this study without any consequence. Additionally, if you do not wish to answer any question in the interview, you may skip it and move on to the next question. All the information you provide will remain confidential and only be used for research purposes, and in publications related to this research. Any data pertaining to you will be reported anonymously in such a way that it is very unlikely to be traceable to you. The findings may be included in my thesis which will be lodged in the University of Waikato Research Commons when it is completed. The data collected for the purpose of this study will remain confidential to my supervisors and me. The transcript of your interview and its audio recording will be stored in a locked space in my office. Electronic data will be kept on a password protected device. The data will be stored for a minimum of five years and after that will be destroyed. This research proposal has been reviewed and approved by the Waikato University Human Research Ethics Committee, to make sure that research participants are protected from harm.

I would appreciate your participation in this interview. If you have any questions, or need more details about this research, please contact me, Fariba Mostafa, fm61@students.waikato.ac.nz, 0211417392. If I am unable to resolve your concerns, you may contact my supervisor Dr Chris Eames, c.eames@waikato.ac.nz, 078384357.

Yours sincerely

Research consent form

I have read the attached letter of information and I understand that:

1. My participation in the project is voluntary.
2. I have the right to withdraw without explanation and any data gathered from me will be destroyed where identifiable as mine.
3. Data may be collected from me in the ways specified in the accompanying letter. This data will be kept confidential and securely stored.
4. Data obtained from me during the research project may be used in the thesis writing or publications related to this project. This data will be reported without use of my name.

I can direct any questions to Fariba Mostafa Email: fm61@students.waikato.ac.nz, phone: 0211417392, WhatsApp: 0211417392

For any unresolved issues I can contact the study project supervisor, Dr Chris Eames, c.eames@waikato.ac.nz, 078384357

I give consent to be involved in the project under the conditions set out above.

Name:

Signed:

Date:

Please email this form to the researcher at: fm61@students.waikato.ac.nz

Appendix I: Information letter and consent form (Phase three)

Kia ora

Thank you for indicating your interest in being part of the EEfS Community through Google+. Your participation in this professional learning community is part of a large PhD research study into teachers' perceptions of professional learning through social media in environmental education. Therefore, I would to consider your activities and posts as data for this study.

As part of my data collection, I would like to analyse your activities, posts, discussion and shared resources in order to understand what happened in the community, and to consider ways in which this learning community helped you. The data will be analysed, interpreted and summarised, and will be used for research purposes and in publications related to this study. The community is a closed group on Google+ and is only accessible to those in the group, and not to the public. Yet, anonymity cannot be guaranteed to all forms of research especially where the use of an online environment is involved. Therefore, it is difficult to promise full assurance of anonymity as posts may be accessed by unscrupulous others. However, every reasonable effort will be made to ensure your anonymity, and you will not be identified in any reports and publications without your explicit permission.

Your participation in this research is completely voluntary, and you can decline to be involved further in this study without any consequence. It is your right to do this without having to give a reason, and there will be no consequences from doing so. If you decline, the data gathered from you in the Google+ will not be analysed.

I would also like to invite you to participate in an online or phone interview, which I expect to last 30 minutes. I would like to audio-record our conversation, with your agreement, so that I can analyse our conversation later. The information recorded from the interview will be kept confidential and no one except me will have access to it. I will then provide you with a transcription of the interview for you to check for accuracy and to make any changes to what you have said. I would ask that this be done within two weeks of receiving it and then returned to me by email. If you do not wish to answer any question in the interview, you may skip it and move on to the next question.

All the information you provide will only be used for research purposes, and in publications and presentations related to this research. The findings may be included in my thesis, which will be lodged in the University of Waikato Research Commons when it is completed. The data collected for the purpose of this study will remain confidential to my supervisors and me. The transcript of your interview and its audio recording will be stored in a locked space in my office. Electronic data, including your posts through the EEfS community, will be kept on a password-protected device. The data will be stored for a minimum of five years and after that will be destroyed. This research proposal has been reviewed and approved by the Waikato University Ethics Committee, to make sure that research participants are protected from harm.

I would appreciate your further participation in this study and if you are happy to do so please complete the attached consent form and return to me. If you have any questions or need more details about this research, please contact me.

Fariba Mostafa, fmostafa@waikato.ac.nz

Phone 0211417392 or WhatsApp 0211417392.

If I am unable to resolve your concerns, you may contact my supervisor. Dr Chris Eames, c.eames@waikato.ac.nz, 078384357.

Yours sincerely

Fariba Mostafa

The informed consent (the research consent form)

I have read the attached letter of information and I understand that:

1. My participation in this research is voluntary.
2. I have the right to withdraw without explanations and any data gathered from me will be destroyed where identifiable as mine.
3. Data may be collected from me in the ways specified in the accompanying letter. This data will be kept confidential and securely stored.
4. Data obtained from me during the research project may be used in the theses writing or publication related to this project. This data will be reported without use of my name.

I can direct any questions to Fariba Mostafa Email: fmostafa@waikato.ac.nz phone: 0211417392, WhatsApp: 0211417392

For any unresolved issues I can contact the study project supervisor, Dr Chris Eames, c.eames@waikato.ac.nz, 078384357

I give consent to be involved in the project under the conditions set out above.

Name:

Signed:

Date:

Please email this form to the researcher at fmostafa@waikato.ac.nz

Appendix J: EEfS Google+ post

